DISSERTATION ON

SCLERAL BUCKLING VS. PARS PLANA VITRECTOMY FOR MACULA OFF RHEGMATOGENOUS RETINAL DETACHMENT

Submitted in partial fulfillment of requirements of

M.S.OPHTHALMOLOGY

BRANCH – III

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MADRAS MEDICAL COLLEGE

CHENNAI – 600 003

THE TAMILNADU DR.M.G.R.MEDICAL UNIVERSITY,

CHENNAI

APRIL 2016

CERTIFICATE

This is to certify that the dissertation titled "**SCLERAL BUCKLING VS. PARS PLANA VITRECTOMY FOR MACULA OFF RHEGMATOGENOUS RETINAL DETACHMENT**" is a bonafide record of the research work done by **DR. PRANAYEE BEHERA,** Post graduate in the Regional Institute of Ophthalmology & Government Ophthalmic Hospital, Madras Medical College and Government General Hospital, Chennai-03, in partial fulfilment of the regulations laid down by the Tamil Nadu Dr. M.G.R Medical University for the award of M.S. Ophthalmology Branch III, under my guidance and supervision during the academic year 2013 – 2016.

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DECLARATION BY THE CANDIDATE

I hereby declare the dissertation entitled **"SCLERAL BUCKLING VS. PARS PLANA VITRECTOMY FOR MACULA OFF RHEGMATOGENOUS RETINAL DETACHMENT"** is a bonafide and genuine research work carried out by me under the guidance of Prof. **Dr. V REVATHI, M.S, D.O.**

DATE: NAME: **DR. PRANAYEE BEHERA**

PLACE:

ACKNOWLEDGEMENT

I express my sincere thanks and gratitude to **Prof. Dr. R. Vimala, M.D., Dean,** Madras Medical College, for permitting me to conduct this study.

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Chennai 600 003

Dear Dr.Pranayee Behera,

The Institutional Ethics Committee has considered your request and approved your study titled **"Scleral Buckling Vs Pars Plana Vitrectomy for macula off rhegmatogenous retinal detachment" No.10062015.**

The following members of Ethics Committee were present in the meeting held on 09.06.2015 conducted at Madras Medical College, Chennai-3.

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13. Tmt.Arnold Saulina, M.A., MSW.,	: Social Scientist

We approve the proposal to be conducted in its presented form.

The Institutional Ethics Committee expects to be informed about the progress of the study and SAE occurring in the course of the study, any changes in the protocol and patients information/informed consent and asks to be provided a copy of the final report.

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INTRODUCTION The term "Retinal Detachment" is a misnomer because retina as whole is not detached. Split occurs between the two primitive layers, the pigment epithelium remaining attached to the bruchs membrane, while the inner layers become separated from it. It would therefore be more appropriate to call as "Separation of the retina". Retinal detachment is an important cause for preventable blindness and accounts for 0.7%. It is responsible for nearly 0.5%-1.5% of the blindness, majority of these being myopic in origin (Pawha 1971). Invention of ophthalmoscope direct and indirect, with scleral indentation, slit lamp biomicroscope, ultrasound has revolutionized thorough preoperative check-up and planning of surgery on rational basis. Newer surgical techniques have increased the visual prospects of surgery. An endeavour is to be constantly made to obtain anatomical reattachment without jeopardising the structural integrity of viable retina and to achieve maximum functional cure. HISTORICAL REVIEW Concepts, techniques of examination, treatment and methodology in clinical studies pertaining to retinal detachment has undergone, a gradual but steady evolution since its recognition in the early 17th century. The relevant historical events are listed below in chronological order. The 18th century 1706 Morgagni described retinal detachment which was shrivelled in a case of ocular trauma. The 19th century 1805 James Ware released subretinal fluid. 1841 Sichel & 1847 Desmarre's described signs of Retinal detachment 1851 Von-Helmholtz reinvented the ophthalmoscope though Babbage did it earlier. 1852 Ruete invented Indirect ophthalmoscope. 1853 Coccius described retinal breaks. 1858 Mueller observed traction bands in cases of retinal detachment. 1861 Stellwag and Donder advocated bed rest. 1861 Giraud Teulon described the first binocular indirect ophthalmoscope. 1863 Von-Graefe successfully dissected a vitreous membrane with a needle. 1869 Iwanoff opined that vitreous detachment preceded retinal detachment and was probably a precipitating factor. 1870 De-Wecker and Jarger thought that retinal breaks caused retinal detachment. 1874 Leber used SRF,CSF and rabbit vitreous for injection into the vitreous cavity. 1881 Martin introduced thermocautery. 1895 Deutschmann attempted division of vitreous strands. 1900 Trantas used his thumb nail for scleral depression to examine the periphery with direct ophthalmoscope. The most significant advancement in this period was the invention of the ophthalmoscope, recognition of retinal breaks and surgical attempts to treat retinal detachment. However the significance of retinal breaks was debated and treatment was applied away from breaks. The 20th century 1906 Gonin revived Leber's theory that retinal breaks caused retinal detachment. 1911 Gullstrand developed the optical principles of slitlamp biomicroscope and introduced reflex free ophthalmoscopy. 1911 Ohm injected air into vitreous after subretinal fluid drainage. 1911 Blaskowicks introduced lamellar scleral resection treatment but not directed towards the retinal hole. 1920 Jules Gonin insisted that retinal breaks produced retinal detachment. 1923 Jules Gonin attempted to close retinal breaks by applying heat and chemical in the region of the hole. Gonins conviction that retinal breaks caused retinal detachment and his application and treatment towards retinal breaks mark the golden era in the history of retinal detachment. The era before Gonins theory is called as PreGonin era and the era after it is known as PostGonin era. 1933 Linder and Strampilli described full thickness scleral resection. Performed the first scleral

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PART I

INTRODUCTION

The term “Retinal Detachment” is a misnomer because retina as whole is not detached. Split occurs between the two primitive layers, the pigment epithelium remaining attached to the bruchs membrane, while the inner layers become separated from it. It would therefore be more appropriate to call as “Separation of the retina”. Retinal detachment is an important cause for preventable blindness and accounts for 0.7%. It is responsible for nearly 0.5%-1.5% of the blindness, majority of these being myopic in origin (Pawha 1971).

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The 20th century

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1933 Linder and Strampilli described full thickness scleral resection. Performed the first scleral buckling away from retinal break.

1934 Bietti described cryosurgery.

1937 Jess was the first to buckle the area overlying retinal breaks by suturing gauze piece over the sclera.

1938 Rosengreen used air in the vitreous and positioned patient to allow air to tamponade the breaks.

1942 Hruby described a pre corneal concave lens for fundus examination.

1947 Schepens popularised and perfected the Indirect ophthalmoscope and scleral indentation.

The indirect ophthalmoscopy not only enabled recognition of retinal detachment but helped in locating peripheral retinal breaks, indirectly contributing to the overall success rate in retinal detachment surgery. The Goldmann, Hruby and Elbayadi lenses provided additional methods of fundus visualisation in conjunction with the perfected slit lamp.

1956 Meyer Schwickerath invented xenon arc photocoagulation.

1957 Schepens introduced scleral buckling with encirclage. Introduced solid silicon implants and radiofrequency diathermy.

1957 Goldmann invented the three mirror lens.

1958 Custodis used a plomb over retinal break and did not drain SRF.

1960 Maimen introduced the first ruby lens.

1962 Cibis injected silicon oil into the vitreous.

1962 Cooper revived cryosurgery.

1965 Lincoff modified custodis technique.

1967 Rutnin described normal fundus periphery.

1968 Kasner showed that removal of vitreous was well tolerated by the eye.

1970 Freeman used air and a rotatable table to invert and tamponade flap of giant tears.

1971 Machemer introduced the procedure of vitrectomy.

1972 Lincoff introduced silicone sponge and advocated cryo and non-drainage of sub retinal fluid, and also tips for finding retinal hole.

1973 Norton reported favourable results with SF6 injection in conjunction with buckling

and vitrectomy in the management of various types of complicated detachment.

1978 Machemer established the role of retinal pigment epithelial cell migration in cases of proliferative vitreoretinopathy.

1979 Lincoff and Usvi used temporary balloon buckle and sutured the retina in giant retinal tears.

1980 Lincoff tried the use of perfluorocarbon gases in the vitreous.

1981 Retina Society Terminology Committee replaced the term MVR and MPP with proliferative vitreous retinopathy which was graded.

1984 Hilton and Grizzard introduced the term “Pneumatic retinopexy”.

ANATOMY

APPLIED ANATOMY

Retina

The retina develops from the optic cup, the outer wall of which forms the pigment layer of retina, the innermost forms the neural layer. The embryological potential space between these two layers is reopened when retinal detachment occurs. This is the site of SRF accumulation. Normally retinal pigment epithelium is held in close apposition with sensory retina by several factors like:

1. Pressure on the retina from fluid movement across its layers.
2. Physical inter digitation of outer segments with RPE microvilli.
3. Presence of a viscous inter photoreceptor matrix that contain glycosaminoglycan which acts as a glue.
4. Ability of the RPE to remodel its apical morphology adjacent to the outer segment.
5. Metabolic activity of the RPE that controls active transport of fluid and ions that keeps the sub retinal space dehydrated.

This light attachment is easily broken down.

The retina has two principal attachments, the first is at the disc where all the nerve fibres collect, the second is at the ora serrata. A lesser degree of attachment is present at the fovea where the two layers of retina seem to cling together and at the vortex vein level.

Factors for rhegmatogenous retinal detachment to occur

1. Full thickness retinal break.
2. Vitreous traction on the break.

3. Liquefied vitreous which dissects the neurosensory retina from retinal pigment epithelium.

Blood supply

The blood supply of the retina is broadly derived from two sources, by direct vessels running in its substance from the central retinal vessels which supply inner retina and by diffusion indirectly from the choroidal vessels which supply outer half.

It follows therefore that with simple retinal detachment outer retinal degeneration occurs, caused by the separation of the neural retina from the underlying choroidal vascular supply.

Vitreous

Vitreous must be regarded as a definite factor in the mechanism of detachment. Embryologically most of the vitreous originate from the retina and this is reflected from the fact that normally there is blending of vitreous and retinal elements.

Vitreous is a transparent ,colourless, gelatinous mass occupying the posterior four fifth of the globe principally attached to retina over an area of about 1.5mm in breadth of the ora serrata. This attachment is a very firm one.

The vitreous is also attached around the disc and around macula. These are lighter attachments and are easily separated.

Degenerative and other pathological changes in the vitreous are concerned with the causation of detachment.

Figure 1: Normal anatomical landmarks

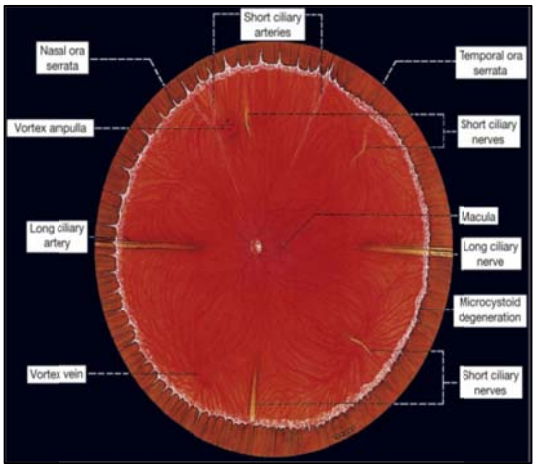
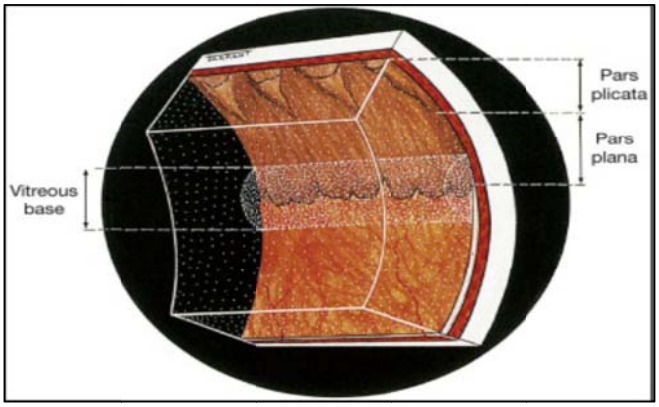


Figure 2: The vitreous base



SURGICAL ANATOMY

Surgical operations in retina depend upon the exact correlation of fundus finding with the topography of exterior of the eyeball.

Pars Plana

It is the posterior part of the ciliary body devoid of ciliary process. It meets the retina at the ora serrata and has a width of 3 mm nasally and 4.5mm temporally. It is located 2.5-4 mm behind limbus.

Ora serrata

The scalloped junction between ciliary body and retina is known as ora serrata. It is located 5.7 mm from limbus nasally and 6.5 mm from limbus temporally. It comprises of the following:

Dentate process: These are teeth like extensions of retina into pars plana. They are more prominent nasally.

Oral bay: The area between the dentate process is known as oral bay. They number 17-34 in an eye.

Meridonial folds: A fold of retina involving the dentate process is termed meridonial fold and is the most commonly noted in the superonasal quadrant. Alignment of a dentate process with ciliary process is known as a meridonial complex.

The ora serrata is located at the insertion of the recti.

Peripheral retina

The area of the retina located between the equator and the ora serrata is termed as peripheral retina. Most of the retinal degenerations culminating in retinal detachment occur in this part of the retina. The equator can be approximately located at the ampulla of vortex vein as noted in the fundus.

Vitreous base

The strongest point of attachment of vitreous to retina and pars plana is the vitreous base. It extends from 1.5 to 2 mm anterior and 2 to 3 mm posterior to ora serrata. It is the place where maximum vitreoretinal adhesion is present and hence most of the tears are noted at its posterior margin.

Vitreous adhesion

Normal:

Vitreous base

Peripapillary region

Macula

Blood vessels

Abnormal:

Lattice degeneration

Post inflammatory lesions (chorioretinal scars)

Vitreous base anomalies

Areas of white with pressure and white without pressure.

PATHOGENESIS

PATHOGENESIS OF NON TRAUMATIC RHEGMATOGENOUS RETINAL DETACHMENT

The fundamental mechanism leading to retinal detachment is incompletely known. However, certain factors in the eye are known to have a strong precipitating effect and others to predispose to retinal detachment. What is striking is that none of the precipitating and predisposing factors seem to affect the nature of fundamental mechanism.

First, the fundamental mechanism that leads to retinal detachment will be discussed and then the precipitating and predisposing factors.

I. FUNDAMENTAL MECHANISM:

This will be considered in 4 headings

a. GENERAL CONSIDERATION:

The pathogenesis of retinal detachment rests on chronic degenerative changes that seem to affect two areas predominantly. The vitreous and inner retinal layer and the pigment epithelium and choriocapillaries.

Circulatory insufficiency in focal areas of the retina results in a degenerative process and atrophy of the inner retinal layers and causes a deficit of metabolites needed by the vitreous. This leads to thickening and adhesion of the vitreous to focal areas of the retina and syneresis of the vitreous gel.

Circulatory insufficiency of the pigment epithelium and choriocapillaries causes a localised breakdown of the existing mechanisms that are responsible for adhesion between the pigment epithelium and photo receptors.

Systemic circulatory insufficiency due to hypertension, chronic lung diseases, diabetes mellitus-all may contribute to the local circulatory insufficiency which forms the basis of the degenerative process.

Figure 3: Horse shoe tear with lattice

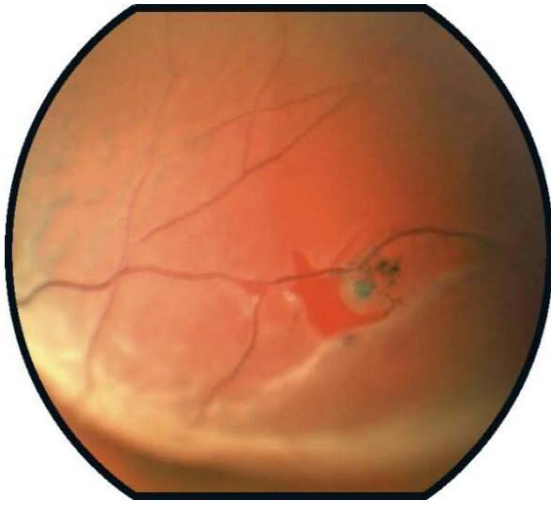
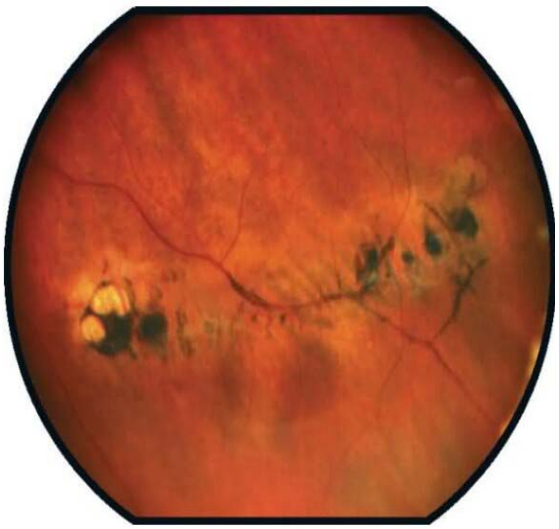


Figure 4: Lattice degeneration with pigment epithelial atrophy



b. FORMATION OF RETINAL BREAKS

Most retinal breaks are found in the periphery of the fundus, as breaks around the posterior pole are rare, because vitreo-retinal adhesions occur infrequently in these areas and the retina is considered stronger in the posterior pole. On the basis of morphological appearance the pathogenesis of retinal breaks are divided into 3 categories –holes, tears and dialysis.

Retinal holes:

Localised vascular insufficiency leads to extreme atrophy of retinal tissue with formation of retinal holes. Retinal detachment need not follow until the vitreous detaches, making available fluid vitreous to float the retina off the pigment epithelium or a degenerative process occurs in the pigment epithelium which throws the adhesive forces off balance.

Retinal tears:

Local vascular insufficiency in the inner retinal layers causes vitreo-retinal adhesions to be established. Vitreous separation follows. When a collapse of the vitreous occurs, traction is exerted on the retina at the level of vitreo-retinal adhesions, resulting in a retinal tear with a free floating operculum or a horse-shoe tear. A vitreous haemorrhage may follow if a retinal vessel which bridges across the retinal tear is torn. Retinal detachment may actively follow its formation due to the vitreous traction forces.

Retinal dialysis:

Vascular insufficiency in the lower temporal quadrant leads to a flat Retinoschisis. As the two layers rupture along the ora serrata, a dialysis sets in which may be benign and less than 90 degree in extent or may extend and become malignant and larger than 90 degree. The speed of development of retinal detachment depends on the mechanism that holds the photoreceptor opposed to the pigment epithelium.

c. LOOSENING OF NORMAL CHORIO-RETINAL ADHESION:

The thin layer of glycosaminoglycans covering the external aspect of the photoreceptors behaves like a visco elastic material. It has been noted that a force of almost 40 to 110 mg was needed to counter this force.

The strength of the adhesion between the photo receptors and the retinal pigment epithelium plays a role in the occurrence and spread of the retinal detachment. This adhesive strength may be lessened due to old age, trauma, in myopes and in aphakia, the common denominator being again vascular insufficiency.

d. INERTIAL FORCES:

Saccadic eye movements set up inertial forces in the vitreous body which cause retinal tears to occur at areas of vitreo-retinal adhesion and the retina to separate from the pigment epithelium and extend the retinal detachment.

In conclusion, it appears probable that the development of a retinal detachment in the presence of a retinal break is the result of two opposing forces, vitreous

traction on the retina and the adhesive force between the photoreceptors and retinal pigment epithelium.

The combination of traction on the retina and of intraocular currents in the presence of a retinal hole is the cause of retinal detachment. The strong suction forces of the pigment epithelium and choroid counteract such a development. Chorio retinal scars serve as a seal against currents. Eliminating the effects of traction and of intraocular currents and making use of the absorption forces of the pigment epithelium and choroid are the primary aims in successfully treating rhegmatogenous retinal detachment.[1]

II. PRECIPITATING FACTORS:

It is well known that breaks may be present in the retina without causing a retinal detachment. These are silent retinal breaks. The following factors tend to precipitate the development of a retinal detachment.

a. MYOPIA:

In the myopic eye the matrix that unites the two photo receptors with the pigment epithelium may be deficient. Thus the normal chorioretinal adhesion is weaker in a myopic eye than in a non- myopic eye. Myopia of greater than -6D has more chances of developing a retinal detachment.

b. APHAKIA:

Cataract extraction is followed by retinal detachment in 2-6% of the cases. Complication during surgery such as vitreous loss, and vitreous haemorrhage

increases the incidence of retinal detachment. It has been proven that the incidence of retinal detachment is higher with an intracapsular cataract extraction than an extra capsular cataract extraction.

III. PREDISPOSING FACTORS:

The mechanisms by which a retinal detachment is produced are influenced by a number of factors.

a. SEX:

There is an insignificant prevalence of the incidence of retinal detachment in males over females.

b. RACE:

Negroes seem to be about ten times less prone to develop retinal detachment than are Caucasians.

c. HEREDITARY:

Genetic transmission of myopia, congenital retinoschisis and vitreous changes predispose to the actual development of retinal detachment.

d. CONGENITAL EYE ANOMALIES:

Certain congenital eye anomalies as choroidal coloboma, lens coloboma and optic pit predispose to the retinal detachment.

e. ROLE OF MIOTICS:

Miotics, particularly strong miotics, have been repeatedly accused of precipitating a retinal detachment.

f. HEREDITARY METABOLIC DISEASE OF CONNECTIVE TISSUE:

Marfans syndrome, Ehler-Danlos syndrome, and Wagners Hereditary Vitreo-Retinal degeneration may be associated with a retinal detachment in 20-30% of cases.

PATHOGENESIS OF TRAUMATIC RHEGMATOGENOUS RETINAL DETACHMENT:

Trauma to the eye either a non perforating injury or a perforating injury may result in a rhegmatogenous retinal detachment

NON PERFORATING INJURY:

Injury to the eye may be a direct or an indirect injury. Retinal breaks resulting from ocular injury are more prevalent along the posterior edge of the vitreous base.

Progression of a retinal detachment in such eyes are usually slow, as these patients are relatively young and show no evidence of vitreous degeneration or vitreous traction, and the inborn chorio retinal adhesion is usually strong.

PERFORATING INJURIES:

Perforating injury leading to retinal detachment may be analysed in 3 groups.

a. without vitreous loss:

Retinal detachment may follow the occurance of a retinal tear due to the primary injury or may follow vitreo-retinal proliferation that exerts traction and causes a retinal detachment.

b. with vitreous loss:

Retinal detachment may follow the traction exerted by the vitreous on the normal retina or can cause a retinal tear which later leads to retinal detachment.

c. with retinal IOFB:

The retina may be detached at the time of primary injury due to the formation of a retinal tear or may follow its removal or retainment due to the proliferative vitreo retinal glial element producing traction.

TYPES OF RETINAL BREAKS

A retinal break is a through and through opening in the neurosensory retina connecting the vitreous cavity with the potential or actual space between the neurosensory retina and the retinal pigment epithelium.

HORSE SHOE TEAR:

A retinal tear ripped open by traction, most often at areas of vitreo-retinal adhesions take the shape of a horse shoe with the ends pointing towards the ora. Such a tear has been dubbed as a horse shoe tear.

ROUND HOLE:

A hole is an opening, often round, in which there is no attached flap of retina. When a piece of retina attached to the detached vitreous face floats internal and anterior to the hole, the piece of retina is called an operculum and the hole is an operculated hole.

RETINAL DIALYSIS:

A retinal dialysis is a tear occurring at the root or ora serrata and is bordered anteriorly by ciliary epithelium and posteriorly by neurosensory epithelium.

ORAL DISINSERTION:

An oral disinsertion occurs when the ora serrata itself is torn from its moorings. Severe injury usually causes this type of tear.

GIANT TEAR:

A giant tear is a name adopted by convention for limbus parallel tears of greater than 90 degree or three clock hours in length. A giant tear may even extend 360 degree.

MACULAR HOLE:

A true macular hole is usually rare. It results from either trauma, or cystic changes at the macula. A lamellar hole is more common.

CLASSIFICATION OF NON-TRAUMATIC RHEGMATOGENOUS RETINAL DETACHMENT:

These cases may be classified as

1. Equatorial Type: This is the most common type originating from lattice degeneration at the equatorial region.
2. Oral Type: Less frequent than the above, originates in retinal tears at the attachment of the vitreous base or at the posterior limit of a meridonial fold.
3. Mixed Type: Eyes with mixed type (oral and equatorial zones) of retinal detachment often have multiple retinal breaks and have poor prognosis.
4. Posterior Pole Type: Retinal detachment due to tears posterior to the equator and macular holes are rare, due to the thickness of the retina posteriorly and the strong chorio-retinal adhesion in that area.

CLINICAL FEATURES

SYMPTOMS

1. **Prodromal Symptoms:**

a) Photopsia: Is a subjective sensation perceived as a flash of light. In eyes with acute PVD it is probably caused by traction at sites of vitreo retinal adhesion. Apparent only on moving the eyes in a particular direction or constantly present.

b) Floaters: (muscae volitantes) A floater is a moving vitreous opacity which is perceived when it casts a shadow on the retina. More common in myopes and senile patients. These can be due to vitreous haemorrhage or degeneration in the vitreous gel. Floaters can be large ring like, cobweb or small spots. Floaters generally appear several days after the onset of the flashes of light.

2. **Field Defect:**

Development of the field defects occur when the retinal detachment extends posterior to the equator due to the spread of SRF. It is perceived by the patients as a black curtain. Defect is usually progressive. Lower field defect is usually appreciated more quickly than the upper field defect.

If detachment is peripheral central vision remains initially normal.

3. **Failing Sight:**

Failing sight is described either as a sudden loss of all central vision or a more gradual distorted vision. Loss of central vision is due to involvement of the fovea by SRF or

by the obstruction of the visual axis by a large upper bullous RD in an eye in which the fovea is still uninvolved.

SIGNS

1. **External examination of the eye:** In RD external examination of the eye appears normal.

2. **Visual Acuity:** Is reduced if macula is involved or by vitreous haemorrhage accompanying the detachment.

3. **Visual Field:** Will show a relative scotoma corresponding to the detached retina. Borders of the field defect are sloping.

4. **Retinoscopy:** Red reflex is altered, appears grey over the area of detached retina.

5. **Anterior Segment**

    a. **Pupil:** A relative afferent pupillary conduction defect (Marcus gunn pupil) is present in eyes with extensive retinal detachments irrespective of the type.

    b. **Anterior chamber:** A mild anterior uveitis is a common finding. Occasionally the inflammation may be severe enough to cause posterior synechiae.

    c. **Intraocular pressure:** is most often decreased in eyes with retinal detachments. Uveitis, blunt trauma, or RD due to neoplasm or choroidal

exudation shows elevation of intraocular pressure. IOP may be rarely increased due to obstruction of the trabecular meshwork by inflammatory cells, pigment granules, photoreceptor outer segment. SCHWARTZ syndrome (Netland et al)[4]

6. Posterior Segment

a. **Ophthalmoscopically** detached retina has a convex configuration, corrugated and general grey appearance due to the fact that the light is reflected from the retina with the crests of the folds appearing white. The SRF extends up to the ora serrata except in the very rare cases of RD's caused by a macular hole. The detached retina is mobile so that it undulates freely with eye movements. Shifting fluid is absent.

The retinal vessels appear dark and tortuous oscillating with the movement of the detached retina. Retinal breaks appear as discontinuities in the retinal surface.[2] As a result of the colour contrast between the sensory retina and the underlying choroid, they are usually red. The breaks are mainly situated in the periphery and midperiphery sometimes being hidden between the folds.

b. **Vitreous:** Pigment cells in the anterior vitreous are strongly suggestive of retinal break. Posterior vitreous detachment, synchysis or syneresis of the vitreous can be present.

SIGNS OF LONGSTANDING RETINAL DETACHMENT

1. **Retinal thinning and atrophy:** seen in long standing Rhegmatogenous retinal detachments.

2. **Sub retinal demarcation lines:** These high water marks are initially pigmented and tend to lose their pigment. Develop at the junction of flat and detached retina and take three months to develop.[2]

3. **Secondary intra retinal cysts:** Develop if the detachment is of one year duration.

4. **Subretinal Fibrosis:** Multiple opaque strands are present on the outer retinal surface.

5. **Proliferative vitreo retinopathy:** Changes can be seen in long standing retinal detachments.

6. **Fixed Retinal Folds:** Are seen in greater frequency.

DIFFERENTIAL DIAGNOSIS

1. **Retinoschisis:**

   Senile Retinoschisis[5]**:** In senile retinoschisis, the retina splits into two layers. In typical, the split is in outer plexiform layer, in reticular type the split is in the nerve fibre layer. The following factors help it to differentiate from Rhegmatogenous RD.70 % of eyes are hypermetropic, largely seen in temporal quadrant (inferior 70%)[6], bilateral in 50-80%.The condition is usually asymptomatic. No tobacco dust or haemorrhage is present. The schisis cavity is dome shaped having a smooth and thin inner wall which on eye movement does not undulate. The outer wall has pocked or pitted appearance. The vessels are often sheathed. Absolute scotoma is found on visual field testing. Breaks in the outer wall, with or without coexistent inner wall holes, can give rise to detachment.

   Juvenile Retinoschisis: In this congenital, sex linked, recessive condition, the retina is split in the nerve fibre layer. Almost affected eyes are hypermetrope and have "cystoid" changes in the fovea. In half of the cases, retinoschisis is confined to the fovea. In the other half foveal changes are accompanied by schisis in inferotemporal quadrant.

2. **Ciliochoroidal Detachment:** Occasionally pre-operatively found in eyes with Rhegmatogenous RD. The ora serrata is detached by the fluid collection and this renders it visible without scleral pressure. Choroidal detachment is dark coloured, having smooth rounded surface not mobile with normal retinal vessels over the detachment. The extent of choroidal detachment is limited anteriorly by the scleral spur and the scleral exits of the vortex veins near the equator posteriorly.

3. **Secondary Retinal Detachment:**

   a. **Exudative Retinal Detachment:** Detached retina is convex, smooth, not corrugated with marked mobility. Shifting of sub retinal fluid is the hall mark of exudative RD and sometimes SRF is so deep that the detachment can be seen with slit lamp without the aid of a contact lens. Some of the diseases causing exudative RD are malignant melanoma of the choroid, metastatic carcinoma, Retinoblastoma, Harada's disease and posterior scleritis.

   b. **Tractional Retinal Detachment:** Common condition causing tractional RD are trauma with retained intraocular foreign body, diabetic retinopathy, retinopathy of prematurity, PHPV, pars planitis, cataract extraction with vitreous incarceration and sickle cell haemoglobinopathy. The surface of the detached retina is concave, peaking at the sites of traction, borders of detachment are scalloped or dentate. Fluorescein angiography does not show leakage or pooling within the sub retinal fluid. A window defect may produce hyperfluorescence. Tractional RD never reaches the equator.

MANAGEMENT

Pre-operative management is considered under the following headings.

a. Patients history

b. Pre-operative examination

c. Bed rest

d. Preparation of patient and his eye.

a. Patient's History

Sequence of symptoms, acute or insidious in onset associated with pain, flashes of light, floaters, total loss of vision.

b. Pre-operative Examination

i. **Visual Acuity:** Visual acuity of the patient with and without glasses and with the addition of pinhole. Patient's refractive error should be measured by retinoscopy.

ii. **Visual Field:** A flat retinal detachment causes a relative field defect. Absolute field defects generally correspond to areas in which the retina is very elevated or detachment is long standing.

iii. **Intraocular pressure:** Usually diminished when retinal detachment is present.

iv. **Anterior Segment Examination:**

Slit lamp biomicroscopy: The corneal transparency, anterior chamber depth, iris pattern and pupillary reaction are assessed. The transparency of the lens is evaluated. In cases of aphakia the position of the position of the anterior hyaloid must be

observed, particularly adhesions of it to the iris or cornea. Presence of cells in the anterior vitreous face is looked for.

v. Posterior Segment Examination:

Ophthalmoscopy

a. **Direct Ophthalmoscopy:** It is preferable for examining small lesions around the posterior pole. A magnification of fifteen times is a definite advantage, but stereopsis is absent and working distance is close to the patient. Depth of field and field of vision is small.

b. **Indirect Ophthalmoscopy:** It is the most ideal method of examination of vitreous cavity and fundus under full mydriasis. Magnification obtained with an indirect ophthalmoscope is inversely proportional to the dioptric power of the condensing lens. Low magnification gives increased field of view. Stereopsis is indispensable for studying changes in the extreme periphery.

It aids in examination of the oral region with the use of scleral depression in order to bring the peripheral structures of the fundus into view. Scleral depressor must be used tangentially to the globe.

Retinal Drawing: Most important and vital step is the documentation on standard retinal chart using international colour code. The retinal drawing chart consists of three concentric circle representing from within outward, the equator, the ora and the junction of the pars plana and pars plicata.

During retinal drawing the number, site, type of retinal breaks, precise relation to standard landmarks such as vortex veins, long posterior ciliary artery/vein, extent of RD, other peripheral retinal degeneration, associated vitreous change should be noted. The retinal drawing of the other eye also must be drawn.

Slit lamp biomicroscopy: Biomicroscopic examination of the vitreous cavity is of value in detecting pathologic changes in the vitreous and retina, also in evaluating vitreo retinal relationship.

Lenses used with biomicroscope are

i. Hruby Lens: A plano concave lens of -58.6 D. This lens provides a small field with low magnification and cannot visualise the fundus beyond the equator.

ii. Panfundoscopic Lens: The wide panaromic view of the retina till the equator is possible. The image viewed with this lens is both vertically inverted and laterally reversed as with indirect ophthalmoscope.

iii. Goldmann triple mirror contact lens: The central portion of the three mirror lens provides a view of 30 degrees around the macula. The equatorial mirror is used to view the area from 30 degrees to the equator, the peripheral mirror, the area from the equator to the pars plana ciliaris. The third mirror is used for gonioscopy and also to view extreme periphery of the fundus.

vi. **Transillumination:** Performed in a dark room with pupil fully dilated, by trans scleral or trans corneal routes. Particularly useful when space occupying lesion is suspected, when a vitreous haemorrhage is present.

vii. **Electroretinography:** It is of subnormal or extinguished type.

viii. **Ultrasonography:** Particularly in the form of B scan helps in the diagnosis of retinal detachment in the presence of cataract and dense vitreous haemorrhage. Echo caused by RD can usually be distinguished from that of choroid if the separation between the two layers is greater than 1.5 mm.

ix. **X-Ray:** Plain X-ray of the eye may be necessary to exclude the presence of intra ocular foreign body.

x. **Fluorescein Angiography:** May be of value when considering the possibility of malignant melanoma and other diseases that may cause non rhegmatogenous detachment.

xi. **Fundus photography:** Documentation of RD is done.

c. Bed Rest

Bed rest for a period of 24 to 48 hours, combined with double padding has been shown to reduce eye movements. The reduction of eye movement and appropriate posturing may sometimes be a useful preoperative adjunct to retinal detachment surgery. Bed rest may be indicated to permit sedimentation of blood in the vitreous cavity and thus improves

fundus view. Patients who require bed rest includes those with temporal retinal detachment that has not yet encroached upon the macula. Visual prognosis is better when macula is attached pre-operatively.

d. Preparation of the Patient:

Thorough medical examination of the patient by a physician is of utmost value to plan the treatment successfully.

OPERATIVE PROCEDURE

"An unending story of a leaking break in a retinal detachment which has to be found and closed once and for all."

About a century ago, rhegmatogenous retinal detachment was essentially untreatable. Jules Gonin was the first to realise that curing RRD required prevention of recruitment of sub retinal fluid through retinal breaks.

The aim of management is to re-attach the retina as quickly as possible by most effective and least traumatic method, with permanent closure of all retinal breaks. The type of surgical procedure selected must also require only a minimal amount of postoperative bed rest and immobility.

Creating an effective chorio-retinal reaction as part of retinal attachment surgery can be achieved by diathermy, cryo application or photocoagulation. Approximating choroid and RPE to retina in the area of breaks is achieved by buckling procedures which push the outer coats of the eye inwards towards the detached retina, or by tamponading the retinal break and pushing the retina outwards towards the RPE and choroid from within the vitreous cavity or by combination of above two methods.

Any technique selected for repair of a primary RD should fulfil the following four requirements:

1. A single operation should reattach the retina.
2. The operation should have a minimum of morbidity.
3. The operation should be done under local anaesthesia and on a small budget.

4. The operation should provide long term visual function, not jeopardised by secondary complications requiring additional procedure.

Methods of producing Chorioretinal adhesion:

a. Diathermy: It is produced by delivering high frequency (MHz) current through the tissues which generates heat due to tissue impedance. It is now rarely used because of the following reasons:

- Causes immediate shrinkage and subsequent necrosis of the sclera.
- Raises IOP due to shrinkage.
- Penetration of diathermy through intact sclera to the retina depends on the scleral thickness. Variations in scleral thickness result in nonuniform and unpredictable transmission of energy to the retina, which can cause choroidal and retinal bleeding, and retinal holes.
- The highest intensity diathermy application actually ruptures sclera, choroid and Bruch's membrane, resulting in scar tissue formation across the entire ocular wall.
- For optimal diathermy application, a lamellar scleral dissection is required to place diathermy burns in a grid pattern in the bed of the scleral dissection with a blunt tipped electrode.

b. Photocoagulation:

Photocoagulation utilises conversion of light into heat energy by ocular tissue. Source of photocoagulation available are:

1. Polychromatic xenon arc
2. Monochromatic pulsed ruby laser
3. Argon laser

4. Diode laser

Photocoagulation is used

1. In prophylactic treatment of retinal breaks.
2. Following vitrectomy membrane peeling, retinotomy etc in the form of endolaser.
3. In pneumatic retinopexy after the break is reattached.
4. In treatment of macular hole.

Photocoagulation can be applied with slit lamp laser delivery system, laser indirect ophthalmoscpe or endolaser. Photocoagulation is not effective in the presence of RD with much SRF.

c. Cryotherapy

Cryotherapy works on the principle of Joule –Thomson effect. Nitrous oxide or carbon dioxide can be used. Cryoprobe tip temperature reaches -79 to -90 degree centigrade. Cryoapplication is almost always monitored. Cryoapplication need not be made on a dry surface and if re-freezing is avoided over treatment seldom occurs. Unlike diathermy, cryoapplications leave no permanent mark on the sclera and often little or no immediate mark in the fundus. Cryoapplications should be confluent because of the relative weakness of the chorio retinal scar they cause.

Methods of approximating Retina with choroid

After a reaction has been obtained in the pigment epithelium,the retina must be approximated with the choroid so that a chorio retinal scar can start forming as quickly as possible. Basics methods available are:

1. Scleral buckling
2. Pneumatic retinopexy
3. Vitreo retinal surgery using pars plana vitrectomy

SCLERAL BUCKLING

The principal of scleral buckling is to close the retinal hole by approximating the pigment epithelium to the detached retina containing the retinal hole. Buckling provides relief of vitreous traction in the plane of the encirclement by reducing the diameter of the globe. By creating false ora serrata there is a theoretical protection against further break formation and re-detachment anterior to the buckle. Retinal holes not detected on examination will be inadvertently sealed if an encirclement procedure is used.

Reattachment can result from several beneficial effects of the scleral buckle.

1. Reduction of vitreoretinal traction
2. Displace subretinal fluid.
3. Modifies the intraocular fluid currents.[7]

Materials and methods of scleral buckling

Buckling materials utilised so far have been diverse. They should be non toxic[8], soft, non antigenic, easy to mould, sterilize[9] and cut in desired shapes. Buckling material may be absorbable and non- absorbable.

Absorbable material are slowly destroyed or integrated by the host tissues. Indentation produced by absorbable implants is less permanent than that produced by non-absorbable materials. Best absorbable material currently available is gelatin.

Non-absorbable materials are used to make permanent buckles. These should not have dead spaces as air pockets which promotes chronic infection and erosion.

a. **Silicone Tyres:** Silicone tyre is a non-absorbable material of choice today. They are translucent, colourless, and easy to cut and do not support bacterial growth and sterilised by autoclaving.
b. **Silicone sponge:** Silicone sponge composition is similar to silicone rubber. It is highly compressible and elastic. Round sponges have diameter of 3mm,4mm and 5 mm and oval sponges are 5.5mm x 7.5 mm. Sponges can be used both for radial and circumferential buckling. The buckle created by a silicone sponge is extensive, high and smooth. Silicone sponge is used mostly as an explant.
c. **Hydrogel:** Combine advantage of both solid silicone rubber and silicone sponges. Can be used both as explant and implant. It is soft, elastic, nontoxic, non pyogenic and devoid of infection. Post operatively it swells up for additional heightening of the buckle.

Buckling is of two types:

Implants

Explants

Implants: Here the material is placed within the scleral flaps to create the buckle.

Advantages of implant

1. It creates a uniformly thin scleral bed which makes easier to treat choroid either with diathermy or cryoapplications.
2. Buckles the sclera more easily and deeply.
3. Smooth and relatively elevated buckles can usually be obtained with fairly small implants.

4. Placement of sutures in the scleral flaps is easy and safe.
5. Scleral flaps cover the implant and protects against implant exposure.

Disadvantages of implant

1. Difficult and time consuming procedure.
2. Perforation is common during lamellar resection.

Explants: Here the material is sutured directly on the sclera to create a buckle. Material used is made up of hard or soft silicone. Procedure is easy to perform.

Configuration of explants: Can be of three types.

1. **Radial buckle:** Radial buckle is placed at right angles to the limbus.
2. **Segmental Circumferential Buckle:** Is placed circumferentially with the limbus to create a segmental buckle.
3. **Encircling Circumferential Buckle**[10]**:** This is placed around the entire circumference of the globe to create a 360 degree buckle.

Radial buckle is preferred in the following situations:

1. Medium to large holes that require a 5 mm buckle or larger.
2. Horse shoe shaped tears- Radial buckles are particularly suitable for buckling this type of hole. The buckle not only closes the tear, but by supporting the tear in its long axis can relieve traction on its anterior aspects.
3. Posterior breaks
4. When there is risk of post- operative fish mouthing[11,12]
5. Combined with encirclement procedure.

Circumferential buckle: is indicated in the following situations:

1. Multiple breaks located in one or two quadrants and at varying distance from ora serrata.
2. Anterior breaks
3. Wide breaks such as dialysis

Encircling buckle is indicated in the following situations

1. Breaks involving three or more quadrants.

2. Lattice degenerations involving three or more quadrants.

3. Extensive retinal detachment without detectable breaks.

4. Mild PVR grade C[13,14,15] to create a permanent 360 degree buckle by reducing the diameter of e globe at the equator.

5. Failed local procedure in which the reason for failure is not apparent.

6. In some aphakic and pseudophakic detachments eg. Total RD with multiple holes.

Scleral Suturing Technique

Explants are secured to the sclera with partial thickness scleral sutures. When using bands, tires or sponges, these sutures are placed in a mattress fashion parallel to the long axis of the elements being supported. To support solid silicon meridonial elements beneath tires or bands, the mattress sutures is placed perpendicularly to the long axis of the meridonial element. Accurate and effective suture placement is critical to the success of explant procedures. A spatula needle with a 5-0 non absorbable sue such as polyester, nylon or polypropylene is used. 4-0 or 5-0 ethibond synthetic suture made up of merselene is commonly used. Usually sutures are placed a minimum of 3 mm further apart than the width

of scleral contact for a given element i.e., 9 mm apart for a 7 mm element. When suturing posteriorly, the vortex veins and their tributaries must be avoided.

The tip of the needle should be in sight in the depths of the tissue when the needle is advanced through. Knots are tied usually anteriorly, if only a smaller buckle is being used, knot could be tied posteriorly for better cosmetic appearance.

Intra Ocular injections:

When normal buckling of the retina is inadequate to secure retinal detachment, intraocular injections may be necessary.

Indications for intraocular injections

1. In giant or irregular retinal tears.
2. Fish mouthing of large retinal tear may lead to failure unless the tear is sealed internally with an air bubble.
3. Radial retinal folds can be flattened.
4. Posterior break, especially if large.
5. To prevent excessive hypotony following drainage of SRF.

Materials used for intraocular injections

Air or Gas: The practice of injecting air into the vitreous cavity has been used for many years. The main disadvantage is that it is usually rapidly absorbed from the vitreous cavity during the postoperative period so that the effect of tamponade is quickly negated.

Sulphur hexafluoride (SF_6): SF_6 is most effective and useful when introduced into the eye. It absorbs nitrogen from the blood so that the bubble of gas increases in size during postoperative period.

Complications: posterior capsular cataract. Positioning of the patient is important when SF_6 is used. When used undiluted may cause dangerous rise of intraocular pressure.

Silicone Oil: silicone oil is completely transparent and possesses high surface tension. The object of injecting this is it completely fills the vitreous cavity permanently and push detached retina against the RPE. It is used in cases having proliferative changes (grade D), unsuccessful detachment operations, giant tears and macular breaks.

Complications:

1. Cataract formation
2. Glaucoma
3. Silicone oil keratopathy

Balanced salt solution: Balanced salt solution is useful in eyes with bullous retinal detachments when SRF has been drained early for accurate localisation of breaks and will help in flattening radial folds.

Disadvantage: Should not be used in eyes with fish mouthing tears because it will pass through the tear into sub retinal space and increases the extent of RD.

Management of sub retinal fluid:

The rationale for drainage of drainage of sub retinal fluid is two folds ,one is to diminish intraocular volume so as to allow elevation of the buckle without difficulties with elevated

intraocular pressure and to allow the retina to settle on the elevated buckle by removing fluid from the sub retinal space.

Indication:

1. Difficulty in localisation of retinal breaks particularly when the break is relatively posterior or located in a highly elevated bullous RD.
2. Immobile retina.
3. Retinal detachments associated with inferior equatorial tears.
4. Eyes with raised IOP.

SRF is preferably drained in lower half of the globe because in the event of the haemorrhage blood will tend to track away from the macula if the patient is upright in the post- operative period or in the most dependant area. SRF can be drained using suture needle or Argon laser. ALD is associated with lower incidence of sub retinal haemorrhage (Aylward et al.)

Non Drainage Operations: The rationale of non-drainage operation is that accurate placement of the scleral buckle, results in closure of the retinal hole either at the time of surgery or in the postoperative period. SRF will be absorbed spontaneously and the hole will gradually sink back against the buckle, usually within a period of 24 to 48 hours.

Advantages:

1. A quieter eye is encountered in the postoperative period.

2. The time of operation is reduced.

COMPLICATIONS OF SURGERY

INTRA OPERATIVE

a. During cryotherapy

1. Inadvertent freezing of the lids may cause marked post-operative lid oedema.
2. Premature cracking may result in scleral rupture more so when sclera is thin.
3. Choroidal haemorrhage[16] may occur if cryotherapy is applied in the region of vortex veins.
4. Pigment fall out occurs from excessive cryotherapy, over freezing or repeated freezing of pigment epithelium.

b. During buckling and scleral suturing

1. During lamellar scleral dissection if the flap taken is too thin, the mattress sutures holding the flaps over the implant may tear out of the flaps or the flap may tear away from the sclera.
2. Unintentional perforation of the scleral bed may allow intrusion of the implant into the eye during surgery.
3. Globe perforation can occur while taking scleral sutures.
4. Corneal clouding- Is usually caused by epithelial oedema from increased intraocular pressure. Epithelium may also become damaged by desiccation or mechanical trauma during the procedure.
5. Damage to vortex veins can occur during placement of scleral sutures.

c. Drainage complication

1. Dry tap usually results from failure to completely perforate the choroid.

2. Choroidal haemorrhage[16] is the most dreadest complication. It may occur at the time of perforation and release of SRF or after fluid has been drained.
3. Retinal haemorrhage occasionally will result from direct trauma by the perforating needle or cautery to the underlying retinal blood vessels.
4. If the SRF is very shallow at the drainage site, retina may become incarcerated[17,18,19] after the flow of SRF has started. If incarceration occurs no attempt should be made to disengage the retina as this may produce iatrogenic retinal tears.
5. Prolonged elevation of IOP above the systolic pressure following excessively tight scleral buckle leads to CRAO. This can be prevented by checking the perfusion of CRA by indirect ophthalmoscopy.

POST OPERATIVE

Early complications

1. **Oedema of the periocular tissues:** Oedema of the periocular tissues with pain is common as result of long and extensive operation and also on the amount of tissue handling during the surgery.
2. **Persistent detachment:** Is due to
    a. Open retinal break.
    b. Buckle failure may be caused by inadequate size, incorrect position or inadequate height.
    c. Missed iatrogenic break.
3. **Anterior segment ischemia:** This is caused by poor perfusion of the anterior segment. It is commoner following encircling operations and when one or more rectus muscle has been dis inserted during surgery.
4. **Sterile uveitis:** this is due either to excessive trauma or to excessive cryotheraphy.

5. **Glaucoma:** more common in circumferential buckling further accentuated by compression of vortex veins with subsequent congestion of the posterior segment.
6. **Choroidal detachment:** Is caused by transudation of choroidal fluid into the suprachoroidal space. The most common predisposing factor is prolonged severe ocular hypotony following drainage of large volume of SRF. Majority of choroidal detachments resolve spontaneously within 2 weeks.
7. **Endophthalmitis:** This devastating complication is much less common after RD surgery.

Late complications

1. **Buckle extrusion and infection**: It is rarely seen these days due of improvement in suturing techniques and sub-tenon antibiotics at the end of operation.
2. **Recurrent retinal detachment**: Late failure is defined as initial reattachment of retina and subsequent re-detachment.
    a. PVR is the most common cause[19].
    b. Reopening of retinal break results from inadequate chorioretinal reaction or to late buckle failure from slippage of an encircling element anteriorly or posteriorly, spontaneous extrusion of buckle, and removal of buckle due to infection or exposure.
    c. New break formation.
3. **Ocular motility disturbance:** this occurs especially if the rectus muscle has been dis inserted or large explants have been placed under them.
4. **Maculopathy:** Following surgery the macula may be damaged in a number of ways
    a. Pre-macular gliosis either in the form of cellophane maculopathy or macular pucker may occur.

b. Atrophic maculopathy typically occurs in eyes with long standing RD.

c. Cystoid maculopathy typically occurs in eyes with longstanding RD.

d. Pigmentary maculopathy is caused by pigment fallout resulting from excessive cryotheraphy.

5. **Refractive changes:** commonly seen with encircling bands[20].

PNEUMATIC RETINOPEXY

Pneumatic retinopexy[3] is an alternative to scleral buckling for the surgical repair of selected retinal detachment. A gas bubble 0.3-0.5 ml is injected into the vitreous cavity and the patient is positioned so that the bubble closes the retinal break(s), allowing absorption of the SRF. Cryotherapy or laser photocoagulation is applied around the retinal break(s), to form a permanent seal. The procedure can be done in an outpatient setting and no incisions are required.

Commonly used gases are sulphur hexafluoride (SF_6), perfluoropropane (C_3F_8), other perfluorocarbon gases such as C_2F6.

Pneumatic retinopexy has particular advantages in the management of certain types of RD.

Indication

1. Macular hole and other posterior retinal breaks.
2. Redatachment following scleral buckling.
3. Optic pit with macular detachment.

Contraindication

1. Breaks larger than one clock hour or multiple breaks extending over more than one clock hour of the retina.
2. Breaks in inferior four clock hours of the retina.
4. Presence of PVR grade C or D.
5. Cloudy media precluding full assessment of the retina.

PARS PLANA VITRECTOMY

Recent developments in vitrectomy instruments, including small gauge systems, wide angle viewing systems, and endoilluminators, as well as many adjuvants led the surgical technique to shift more towards PPV.

Indications

1. Wide and bullous RD.
2. RD with marked traction.
3. Multiple quadrant breaks.
4. Absence of apparent retinal breaks in pseudophakic patient.
5. Severe PVR changes.
6. Vitreous opacities like haemorrhage, pigments and debris.

Principles

1. Removal of vitreous gel and pre retinal tractional membrane.
2. Flattening of the detached retina intra operatively.
3. Retinopexy
4. Tamponading the vitreous cavity.

Surgical techniques

Pars plana vitrectomy is usually performed using a wide angle viewing system attached to an operating microscope**.**

The surgical steps are as follows:

1. Creating three ports through the pars plana.
2. Core vitrectomy.
3. Peripheral vitrectomy.
4. Fluid air exchange.
5. Photocoagulation or cryopexy of the retinal tears.
6. Tamponade.
7. Positioning after surgery.

Advantages:

1. Pars plana vitrectomy is the only procedure that directly removes vitreous traction by lysing the vitreous strands adherent to the flap of the horse shoe tear.
2. Vitrectomy removes media opacities clearing the visual axis.
3. Vitrectomy can reliably achieve complete, intraoperative retinal reattachment, either by internal drainage of SRF or by use of perfluorocarbon liquids to displace the SRF.

OTHER SURGICAL OPTIONS

1. Vitrectomy with encircling buckle.
2. Vitrectomy with phacoemulsification and intraocular lens implantation.
3. Sutureless microincision vitrectomy surgery.

INTRAOPERATIVE COMPLICATIONS

1. Inadvertent placement of infusion cannula in the subretinal or subchoroidal space.
2. Damage to the lens due to touch of instruments.
3. Iatrogenically induced retinal tear.

4. Entry of PFCL into the subretinal space.
5. Incarceration of vitreous in the sclerotomy sites.
6. Choroidal haemorrhage.

POSTOPERATIVE COMPLICATIONS

1. Fluid loss through the sclerotomy sites.
2. Development of cataract.
3. Redetachment of the retina.
4. Retention of PFCL in the subretinal layers.
5. Persistence of sub foveal fluid.

SPR Study[28]:

- European Multicentre Study
- Compares primary vitrectomy with scleral buckling for primary retinal detachment repair of medium severity.
- The results of the study are as follows:

OUTCOME	SCLERAL BUCKLING	VITRECTOMY
Phakic		
Improvement in BCVA	-0.71	-0.56
Primary success	63.6%	63.8%
Primary reattachment	73.7%	74.9%
Aphakic/Pseodophakic		
Improvement in BCVA	-0.56	-0.65
Primary success	53.4%	72.0%
Primary reattachment	60.1%	79.5%

Other selected comparative trials on scleral buckling versus primary vitrectomy in RRD are:

Study	Year	Patients (n)			SOSR
		SB	PPV	PPV/SB	
Tewari et al.[27]	2003	20	0	20	Equivalent SOSR (70% SB, 80% SB/PPV), equivalent VA (median 20/120 SB, 20/200 SB/PPV)
Afrashi et al.	2004	30	0	22	Higher SOSR (80% SB, 90% SB/PPV)
Stangos et al.	2004	0	45	26	Equivalent SOSR (98% PPV, 92% SB/PPV), equivalent VA (improve ≥3 lines in 60% PPV, 69% SB/PPV)

Sharma et al.[25]	2005	25	25	0	All PsRD, Equivalent SOSR (76% SB, 84% PPV), better VA with PPV (20/150 SB, 20/71 PPV)
Brazitikos et al.	2005	75	75	0	All PsRD, Higher SOSR for PPV (83% SB, 94% PPV), equivalent vision (20/50 SB, 20/43 PPV)
Halberstadt et al.	2005	190	0	53	PhakicRD 88.9% SB, 82.1% SB/PPV; PsRD 87.7% SB, 77.6% SB/PPV
Heimann et al.[26]	2007	342	339	0	PhakicRD 63.6% SB, 63.8% PPV; PsRD 53.4% SB, 72% PPV; No diference in VA
Azad et al.[24]	2007	31	30	0	80.6% SB, 80% PPV
Pastor et al.	2008	108	278	160	Global SOSR 94.7%, equivalent (phakicRD/PsRD)

PERSPECTIVES

Finding the break and sealing it off sufficiently is of primary importance in achieving permanent results in detachment surgery irrespective of the type of surgery. Further work up is necessary in depicting the optimal surgical approaches for the treatment of Rhegmatogenous retinal detachment.

PART II

AIM OF THE STUDY

The purpose of the study was to analyse and compare the efficacy of Scleral Buckling and Pars Plana Vitrectomy in eyes with macula off rhegmatogenous retinal detachment.

The analyses and comparison was done in terms of

1. Functional outcome:

   Improvement in visual acuity.

2. Anatomical outcome:

   Anatomical reattachment of the detached retina.

MATERIAL AND METHOD

This study was carried out at Uvea and Retina services, Regional Institute of Ophthalmology, Government Ophthalmic Hospital, Chennai over a period of 1 year.

Study design: Prospective interventional study.

Inclusion criteria:

1. Patients who were diagnosed to have primary rhegmatogenous retinal detachment with macula off evident on indirect ophthalmoscopy.
2. Duration of retinal detachment less than 3 weeks.

Exclusion criteria:

1. Presence of other ocular disease.
2. Uncontrolled diabetes, hypertension and other systemic diseases.
3. Extensive proliferative vitreoretinopathy.
4. Duration of retinal detachment more than 3 weeks.

Sample size:

30 patients having Rhegmatogenous Retinal Detachment with macula off evident by clinical features and ocular examination.

Subject selection:

All cases with rhegmatogenous retinal detachment

1. Of any age or sex.
2. H/O defective vision or floaters or photopsia.
3. No other ocular disease.
4. Without uncontrolled Diabetes, Hypertension or any other systemic disease.
5. Fundus examination showing the retinal detachment with macula off along with retinal breaks.

Methods:

30 consecutive patients diagnosed as having rhegmatogenous retinal detachment with macula off are to be taken for surgical repair. Preoperative data included age, sex, visual acuity, intraocular pressure, slit lamp examination, fundus examination using indirect ophthalmoscope with a 20D lens, B scan. Patients are to be divided into two groups. Group 1 included the cases who underwent scleral buckling procedure, while Group 2 included the pars plana vitrectomy cases. In group 1 scleral buckling is to be done using silicon band. Trans-scleral cryopexy and sub retinal fluid drainage is to be done if necessary. In group 2 Pars plana vitrectomy is to be done along with the use of Perfluorocarbon liquid and air fluid exchange. Silicon oil and endolaser is to be used if necessary. Patients are to be followed up at immediate postop, 2 weeks, 1 month and 2 month period. The outcome of the two groups is supposed to be measured and compared.

Anaesthesia:

In cases operated under local anaesthesia facial and peribulbar blocks with lignocaine 2% and bupivacaine 0.5% was given. General anaesthesia was given in children, young adults and in very nervous patients.

Pupils were dilated with tropicamide and phenylephrine combination eye drops.

Surgical procedure:

Group 1:

Skin preparation of all patients was done with 10% povidone iodine and plastic adhesive sterile drape applied. Surgical procedures were uniform except for some minor variations. 360 degree conjunctival peritomy was done. Conjunctiva and tenons opened and relaxing incisions made. Bridle sutures applied to all the 4 recti muscle taking care to preserve the muscle sheath. 4 partial thickness scleral tunnel was made in between the recti muscle approximately 13 mm away from the limbus. Silicone band was passed alternately through the tunnel and underneath the recti muscle. Indirect ophthalmoscopy was done to localise the position of break. Breaks not under the buckle area are marked out. Cryopexy was done under indirect ophthalmoscope visualisation for all retinal breaks. SRF drainage was done in the quadrant where maximum level of fluid was present, as and when required prior to application of silicon band. Fundus was checked to look for the position, height of the buckle, adequacy of drainage and the state of central retinal artery. Intraocular pressure was noted. When all the parameters were adequate and satisfactory the sleeve for the silicon band is attached and tightened as required to meet the desired buckle height. Conjunctiva closed with 10-0 ethilon sutures. Sub-conjunctival steroid and antibiotic injection combination was given at the end of surgery.

Group 2:

Skin preparation of all patients was done with 10% povidone iodine and plastic adhesive sterile drape applied. Surgical procedures were uniform except for some minor variations. Conjunctival peritomy was done. 3 sclerotomy ports are made through the pars plana route.

Core vitrectomy was done first. Posterior vitreous detachment was induced if not present prior. Peripheral vitrectomy was followed after. Perflorocarbon liquid (PFCL) was used to flatten the retina and drain the sub retinal fluid. Under the PFCL bubble, endo-photocoagulation was performed. 2 to 3 rows of endolaser around each break were made to assure reattachment of retina. Following which air fluid exchange was done. C_3F_8 was replaced for air. Conjunctiva closed with 10-0 ethilon sutures. Sub-conjunctival steroid and antibiotic injection combination was given at the end of surgery. Patients were positioned in face down to reassure the macular reattachment.

Review

Patients are to be followed up at immediate postop, 2 weeks, 1 month and 2 month period.

At each visit the status of anterior segment, fundus, and visual acuity was checked and recorded in all the patients.

Figure 5: Superotemporal Retinal detachment (OS)

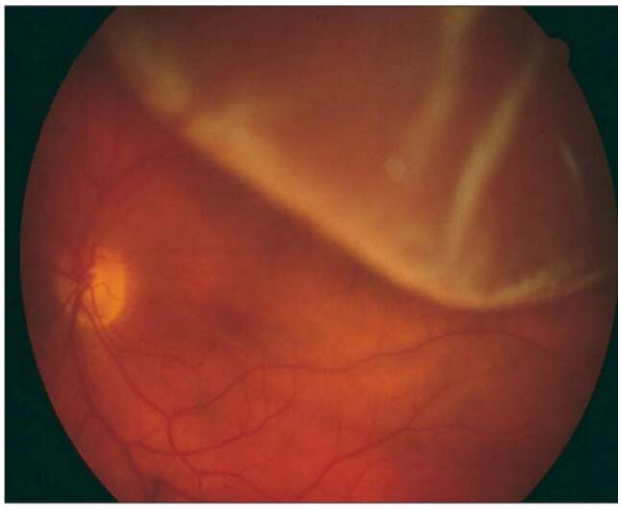


Figure 6: Rhegmatogenous Retinal Detachment

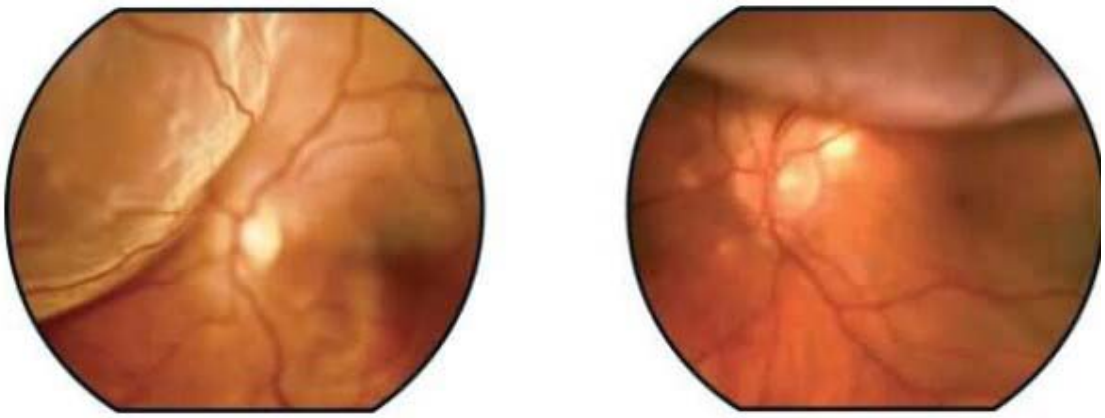


Figure 7: Anatomical re-attachment of retina (postoperative image)

Figure 8: Image depicting buckle effect

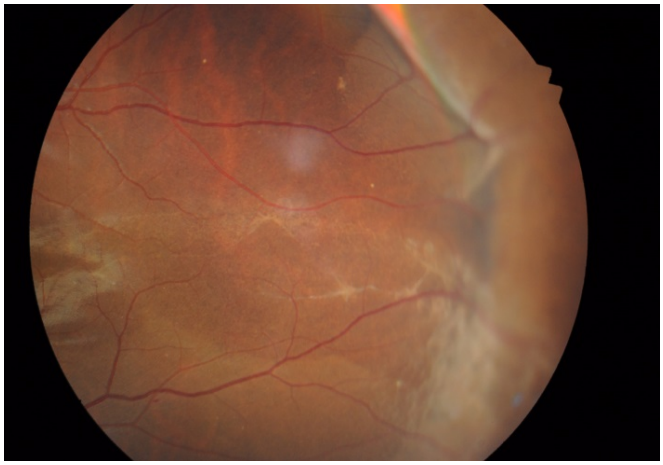


Figure 9: Image depicting cryoreaction postoperatively

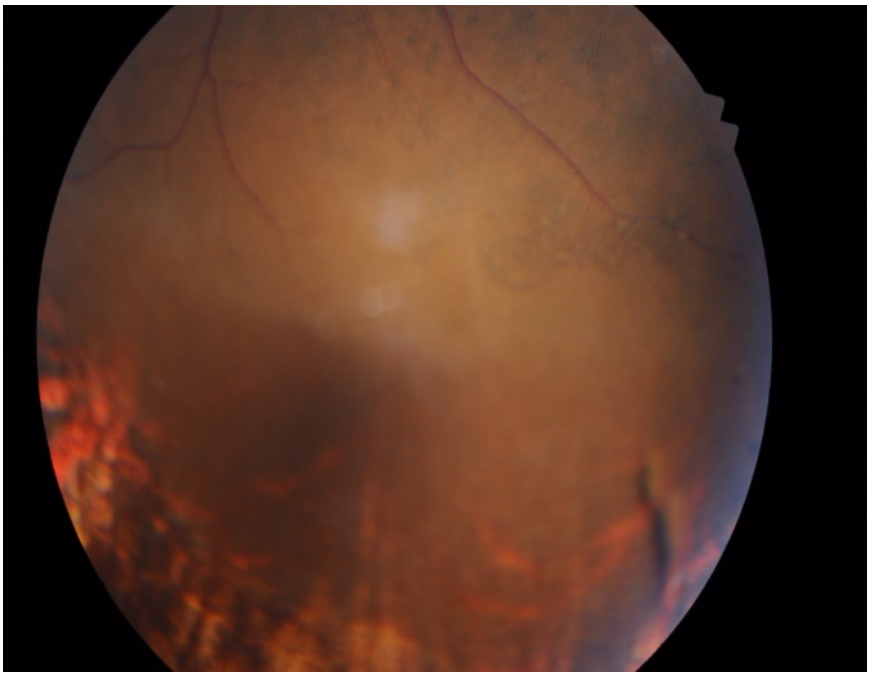


Figure 10: Horse shoe tear post barrage laser

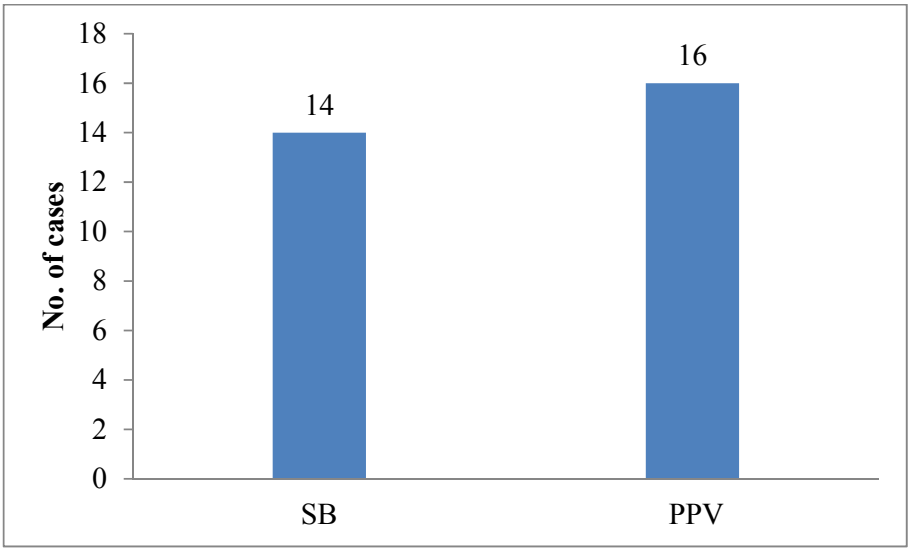
RESULT AND ANALYSIS

The study included 30 patients with macula off rhegmatogenous retinal detachment.

Table 1: No of Cases

Group	No. of Cases n (%)
SB	14 (47)
PPV	16 (53)
Total	**30 (100)**

Chart 1: No of Cases

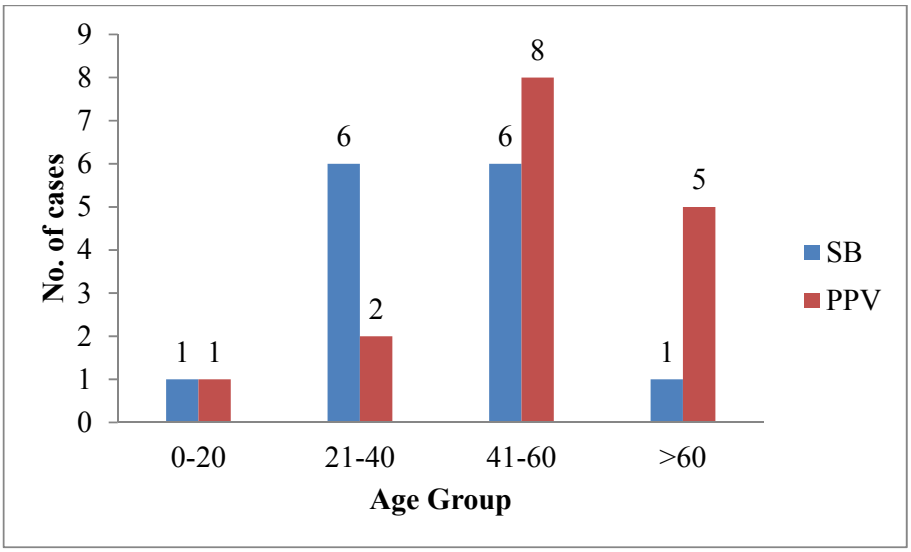


Out of the 30 patients 14 patients were included in scleral buckling (SB) and 16 patients were included in Pars Plana Vitrectomy (PPV).

Table 2: Age Distribution

Age Group, years	No. of cases	
	SB, n (%)	PPV, n (%)
0-20	1 (7)	1 (6)
21-40	6 (43)	2 (13)
41-60	6 (43)	8 (50)
>60	1 (7)	5 (31)
Total	**14(100)**	**16(100)**
Range, years	20 – 65	12 – 75
Mean, years	39.4	54.0
SD, years	16.7	16.6

Chart 2: Age Distribution

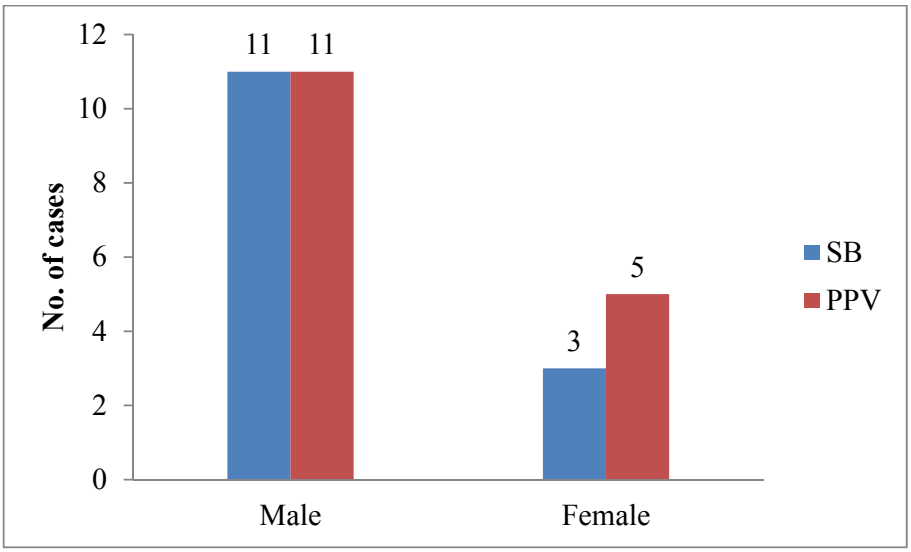


The above table depicts that the mean age of patients in SB group is 39.4 years and in PPV group is 54.0 years. In SB group, 43% of patients fell equally in the age range of 21 -40 years and 41-60 years. In PPV group, 50% of patients fell in the range of 41-60 years.

Table 3: Sex Distribution

Sex	No. of cases	
	SB, n (%)	PPV, n (%)
Male	11 (79)	11 (69)
Female	3 (21)	5 (31)
Total	**14(100)**	**16(100)**

Chart 3: Sex Distribution

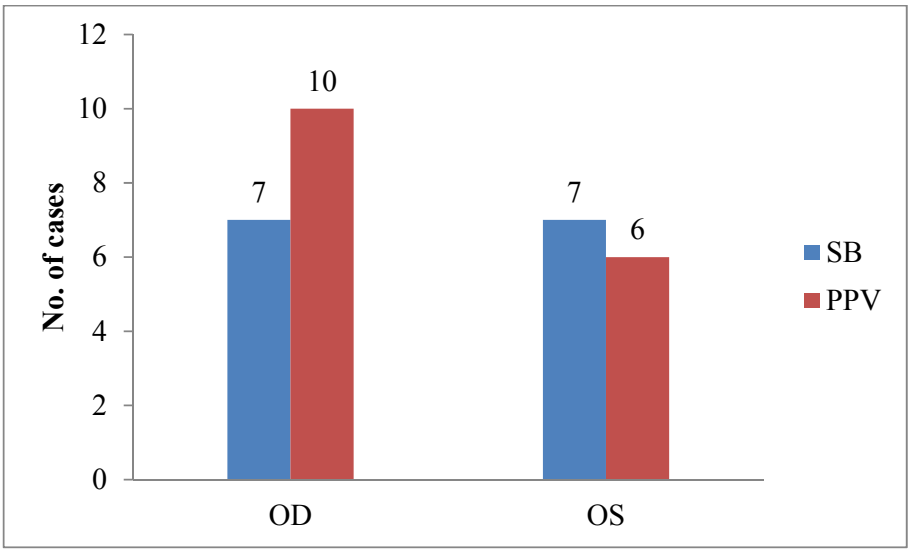


Males are more involved than females in the study. In SB group, 79% of the patients were male while in PPV group 69% of the patients were male.

Table 4: Laterality

Eye	No. of cases		
	SB, n (%)	PPV, n (%)	p-value*
OD	7 (50)	10 (62.5)	0.47
OS	7 (50)	6 (37.5)	0.78
Total	**14(100)**	**16(100)**	

Chart 4: Laterality

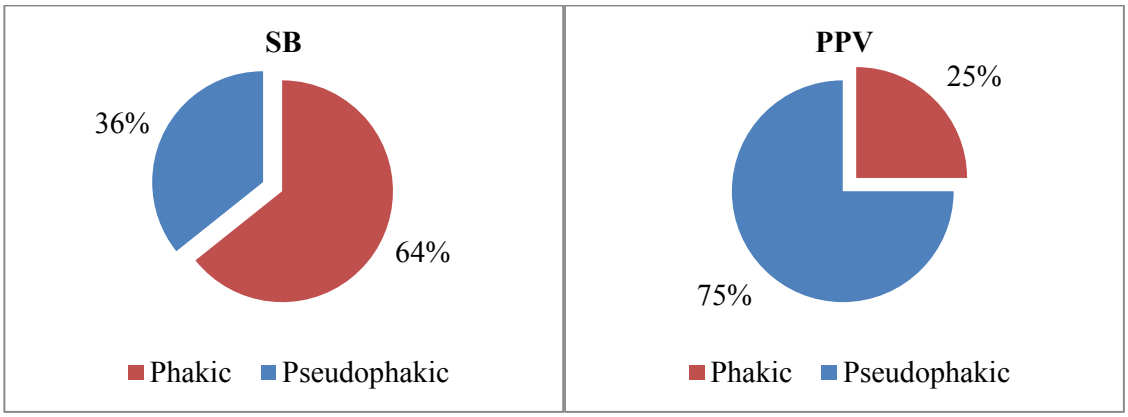


The table represents equal involvement of right and left eye in SB group where as in PPV group right eye was more involved (62.5%).

Table 5: Lens Status

Lens	No. of cases		
	SB, n (%)	PPV, n (%)	p-value
Phakic	9 (64)	4 (25)	0.17
Pseudophakic	5 (36)	12 (75)	0.09
Total	**14(100)**	**16(100)**	

Chart 5: Lens Status

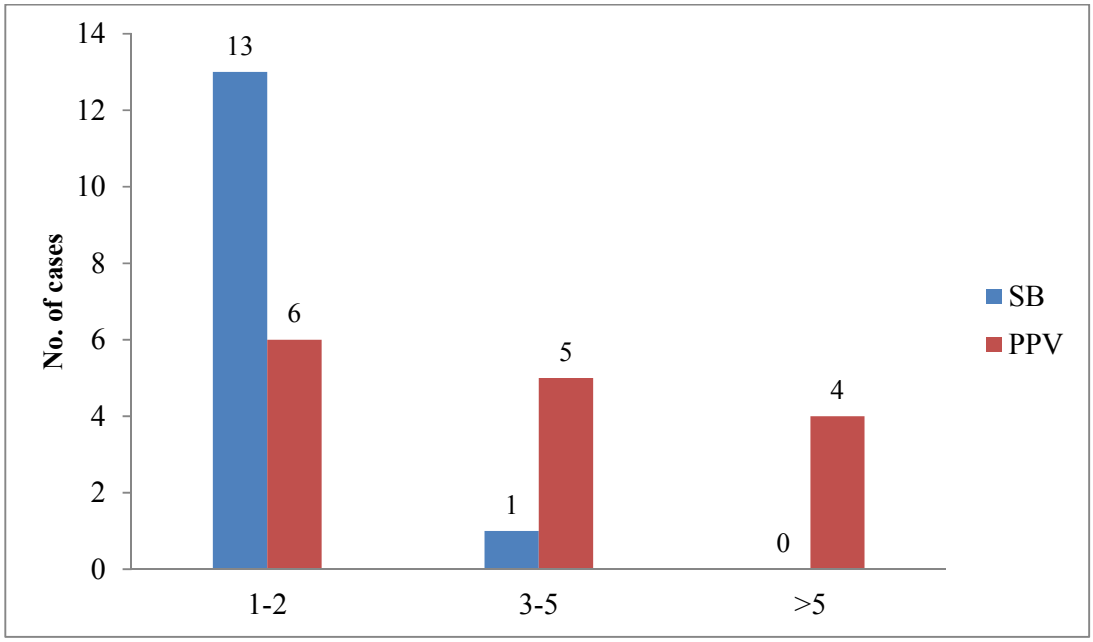


In SB group, 64% of eyes involved are phakic and in PPV group, 75% of eyes involved are pseudophakic. Though SB group included more of phakic eyes as compared to PPV group, but the involvement was not statistically significant (p=0.17). Similarly PPV group included more of pseudophakic eyes as compared to SB group; however the involvement was not statistically significant (p=0.09).

Table 6: No. of Breaks

No. of breaks	No. of cases	
	SB, n (%)	PPV, n (%)
1-2	13 (93)	6 (38)
3-5	1 (7)	5 (31)
>5	0 (0)	4 (25)
Total	**14(100)**	**15(94)***

Chart 6: No. of Breaks



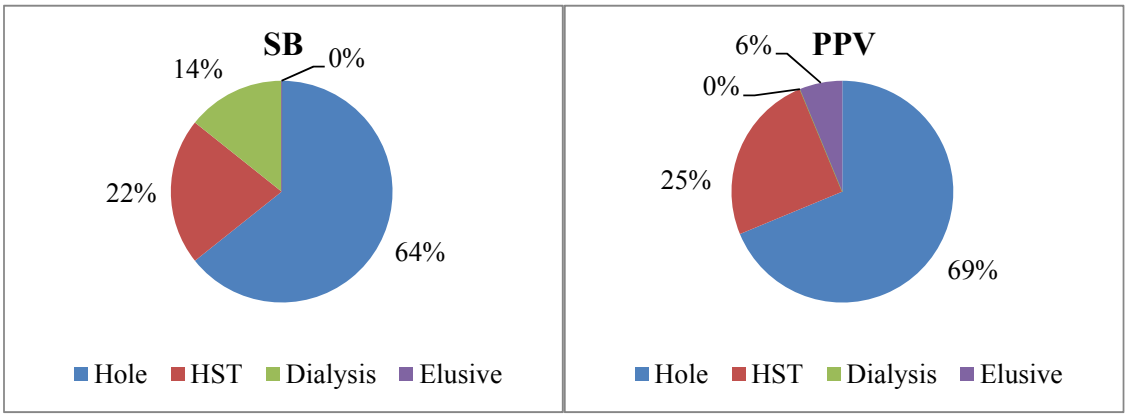
In SB group 93% of the cases had breaks less than equal to 2, while in PPV group the corresponding number was 38%. 25% of cases in PPV group had more than 5 breaks.

*For 1 patient in PPV group the holes were not made out (elusive).

Table 7: Type of Breaks

Type of breaks	No. of cases	
	SB, n (%)	PPV, n (%)
Hole	9 (64)	11 (69)
HST	3 (21)	4 (25)
Dialysis	2 (14)	0 (0)
Elusive	0 (0)	1 (6)
Total	**14(100)**	**16(100)**

Chart 7: Type of Breaks

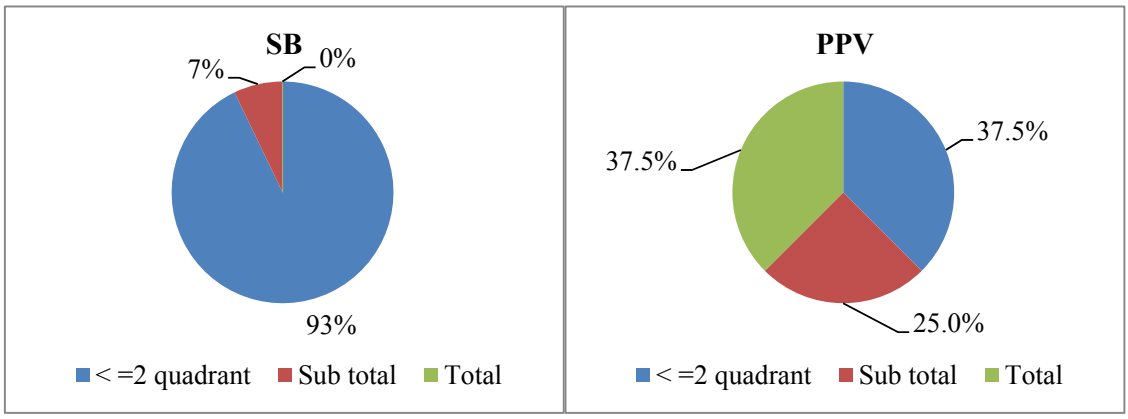


In both the scleral buckling (SB) and pars plana vitrectomy (PPV) group the most common type of break was found to be hole. 64% eyes had holes in SB group while it was 69% in PPV group. In PPV group breaks were elusive in 1 (6%) eye.

Table 8: Extent of RD

Extent of RD	No. of cases	
	SB, n (%)	PPV, n (%)
< =2 quadrant	13 (93)	6 (37.5)
Sub total	1 (7)	4 (25.0)
Total	0 (0)	6 (37.5)
Total	**14(100)**	**16(100)**

Chart 8: Extent of RD

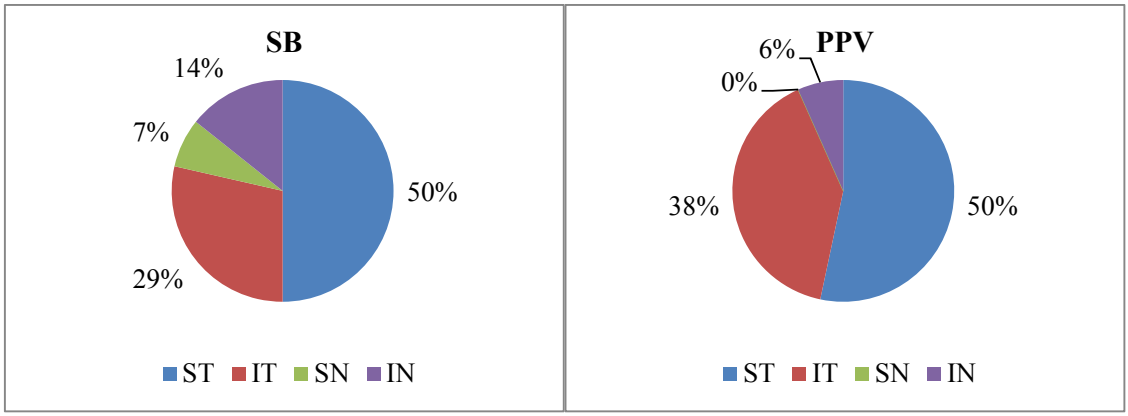


In SB group the extent of retinal detachment was less than 2 quadrants in 93% of the cases where as it was 37.5% in PPV group. Thus in this study PPV group included cases where extent of RD was found to be more extensive than SB group.

Table 9: Break Localisation

Break Localisation	No. of cases		
	SB, n (%)	PPV, n (%)	Total, n (%)
ST	7 (50)	8 (50)	15 (50)
IT	4 (29)	6 (38)	10 (33)
SN	1 (7)	0 (0)	1 (3)
IN	2 (14)	1 (6)	3 (10)
Total	**14 (100)**	**15 (94)***	**29 (97)**
		p-value	**0.001**

Chart 9: Break Localisation



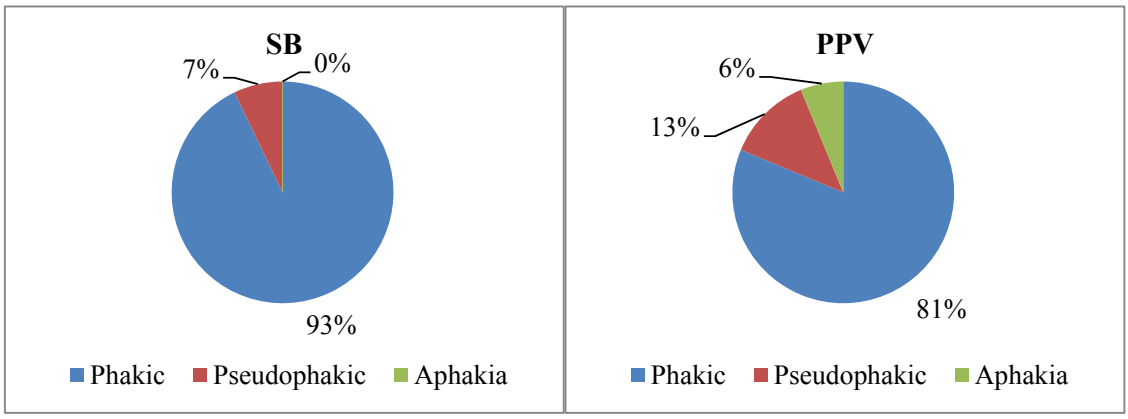
On the whole breaks were most commonly localised in superotemporal quadrant, which was proved to be statistically significant (p=0.001). SB and PPV group both had 50% of cases with breaks localised in superotemporal quadrant. The next most common quadrant with breaks was inferotemporal quadrant.

*Breaks were not made out (elusive) in 1 case of PPV group.

Table 10: Fellow Eye Status

Fellow Eye Status	No. of cases	
	SB, n (%)	PPV, n (%)
Phakic	13 (93)	13 (81)
Pseudophakic	1 (7)	2 (13)
Aphakia	0 (0)	1 (6)
Total	**14 (100)**	**16 (100)**

Chart 10: Fellow Eye Status

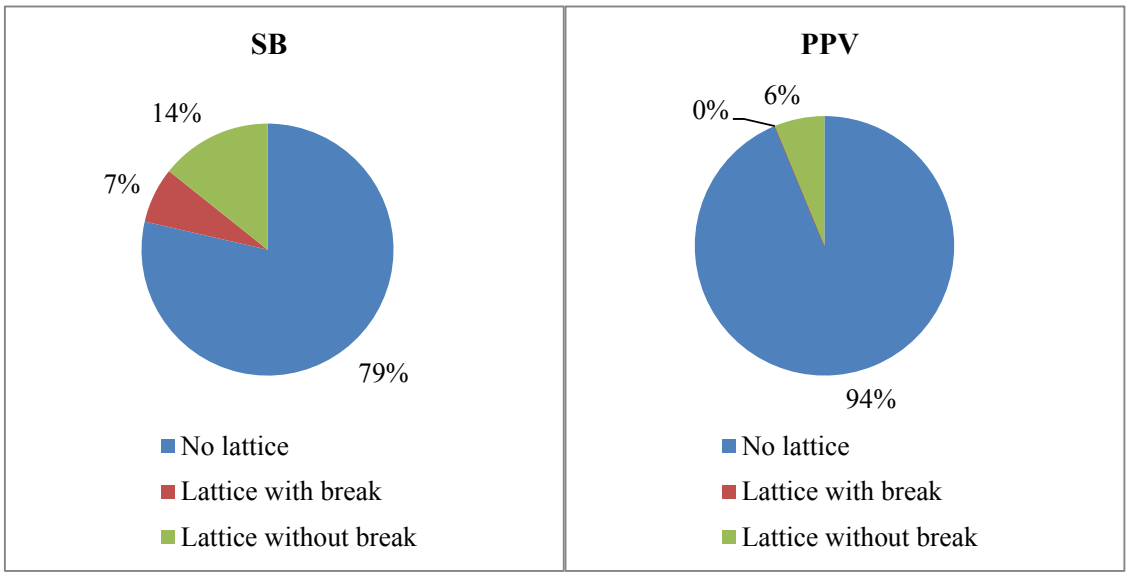


In SB group the fellow eyes were found to be phakic in 93% and pseudophakic in 7% of cases. Where as in PPV group 81% of fellow eyes were found to be phakic, 13% pseodophakic and aphakic in 6% of cases.

Table 11: Fellow Eye Status

Fellow Eye Status	No. of cases	
	SB, n (%)	PPV, n (%)
No lattice	11 (79)	15 (94)
Lattice with break	1 (7)	0 (0)
Lattice without break	2 (14)	1 (6)
Total	**14 (100)**	**16 (100)**

Chart 11: Fellow Eye Status



In SB group 14% of fellow eye had lattice without any break where as 7% had lattice with associated breaks. In PPV group only 6% of fellow eye had lattice not associated with any break.

Table 12: Anatomical Result

Anatomical Result	No. of cases		
	SB, n (%)	PPV, n (%)	p-value
Attached	12 (86)	13 (81)	0.84
Non Attached	2 (14)	3 (19)	0.65
Total	**14 (100)**	**16 (100)**	

Chart 12: Anatomical Result (Pie-Chart)

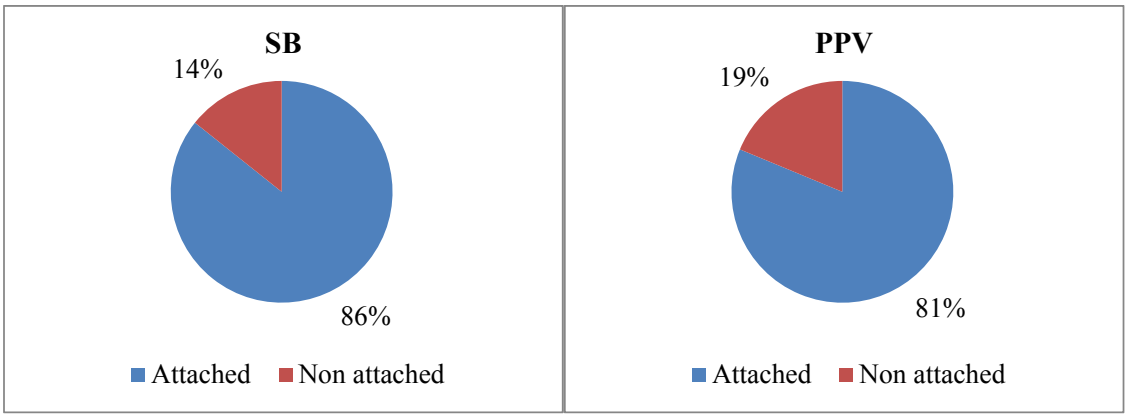
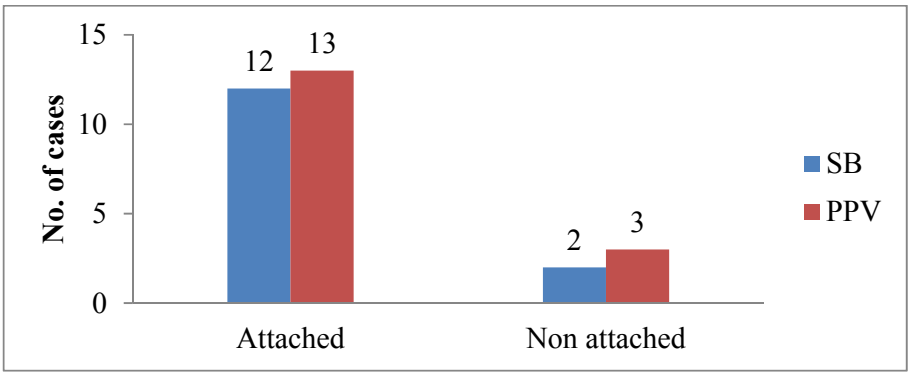


Chart 13: Anatomical Result (Bar-Chart)



Postoperatively anatomical attachment of retina was achieved in 86% of cases in SB group where as it was 81% in PPV group. Though it seems that anatomical outcome of SB group was better than PPV group, but the difference was not found to be statistically significant (p=0.84).

Table 13: Functional Result

Functional Result (log MAR)	No. of cases		
	SB, $\bar{x} \pm SD$	PPV, $\bar{x} \pm SD$	p-value
Preop VA	1.9 ± 0.8	2.2 ± 0.8	0.046
Postop VA	0.9 ± 0.3	1.1 ± 0.3	0.001

The mean preoperative visual acuity in log MAR was 1.9 ± 0.8 in SB group where as it was 2.2 ± 0.8 in PPV group. The preoperative visual acuity in SB group was better than PPV group which is proved to be statistically significant (p=0.046).

The mean postoperative visual acuity in log MAR was 0.9 ± 0.3 in SB group where as it was 1.1 ± 0.3 in PPV group. The postoperative visual acuity in SB group was better than PPV group which is proved to be statistically significant (p=0.001).

So in this study the functional outcome in terms of best corrected visual acuity was found to be better in SB group compared to PPV group which was also found to be statistically significant.

Table 14: Causes of failure

Reasons for retina not attached	No. of cases
PVR changes with breaks	1
PVR changes	1
Residual SRF + Breaks	1
Macular haemorrhage	1
Residual SRF	1

Retina was not found to be postoperatively attached in 5 cases out of the total 30 cases. The reason of failure being PVR changes ± breaks, residual SRF ± breaks and macular haemorrhage.

Statistical tools:

The information collected regarding all the selected cases were recorded in a Master Chart. Data analysis was done with the help of computer using “Microsoft Excel”. Using this software range, frequencies, percentages, means, standard deviations, chi square ‘t’ value and 'p' values were calculated. ‘t’ test was used to test the significance of difference between quantitative variables and Yate’s and Fisher’s chi square tests for qualitative variables. A 'p' value less than 0.05 is taken to denote significant relationship.

DISCUSSION

Closure of retinal breaks and release of vitreous traction on the retina is the goal of all retinal detachment surgery. Scleral buckling surgery releases the radial vitreous traction and brings the retina in close contact with the RPE. Pars Plana Vitrectomy enables instrumental release of vitreous traction, internal drainage of SRF and achieves attachment of retina at the operating table itself.

Number of authors reported that PPV gives good results if done as first surgical method for retinal detachment. It is especially valid for pseudophakic eyes. According to de la RUA et. al. SB surgery in pseudophakic eyes increases the risk of PBR. The study of Heimann et. al. shows SB to be better in phakic eyes with respect to BCVA improvement. They also recommended PPV in psedophakic patients from anatomical point of view. Azad et. al. in their study showed that SB and PPV group proved to be equally efficient in view of anatomical outcome.

By analysing our results we find the following:

1. The mean age group of involvement in SB group was 39.4 years whereas in PPV group it was 54 years.
2. Males were more commonly involved in both the groups.
3. Right eye and left eye was equally involved in SB group. Whereas right eye was more involved (62.5%) in PPV group.
4. SB group included 64% of phakic eyes whereas PPV group included 75% of pseudophakic eyes. Thus SB was opted more in phakic eyes and PPV in psedophakic eyes.

5. In SB group 93% had breaks ≤ 2, whereas PPV included breaks ≤ 2 (38%), breaks 3 to 5 (25%) and breaks > 5 (25%). Thus SB group included RD with fewer breaks whereas PPV included eyes with more number of breaks.
6. In both the groups' hole was fond to be the most common type of break.
7. SB group included 93% of cases where the extent of RD was limited to 2 quadrants whereas PPV group comprised of 37.5% cases with ≤ 2 quadrant involved, 25% cases with sub-total and 37.5% cases with total involvement of retina. Thus PPV group included cases where the extent of RD was extensive in comparison to SB group.
8. In both the groups' breaks were most commonly localised in ST quadrant followed by IT quadrant.
9. 7% of fellow eyes had lattice with break in SB group. Lattice without break were found in 14% of fellow eye in SB group whereas the involvement was 6% in PPV group.
10. Anatomical attachment of retina was found to be equivalent in both the group which agrees with Azad et. al. study.
11. Functional outcome in terms of post-op BCVA was found to be better in SB group in comparison to PPV group which as statistically significant (p=0.001). This agrees with recent retrospective studies.[21,22,23]
12. Reasons for retina not attached included PVR changes ± breaks, residual SRF ± breaks and macular haemorrhage.

CONCLUSION

Though there are varied means of approach for retinal detachment surgery, appropriate case selection is of utmost value for achieving the desired result. Following conclusions are drawn from this study:

1. Retinal detachment is more common in age group of 41- 60 years.
2. Males are more commonly involved in both the groups.
3. Scleral buckling is preferred in eyes with fewer breaks, whereas pars plana vitrectomy is opted in eyes with large number of breaks.
4. Scleral buckling is preferred when the extent of detachment is limited to 2 quadrant, whereas pars plana vitrectomy is preferred in eyes with detachment extending more than 2 quadrants.
5. Superiotemporal quadrant is more commonly involved with breaks.
6. Fellow eye should always be looked for lattice and breaks.
7. Both the groups faired equally well in consideration to anatomical outcome.
8. In view of functional outcome, scleral buckling group outstanded pars plana vitrectomy group. The mean post-operative BCVA in scleral buckling group is significantly better compared to pars plana vitrectomy group (p=0.001).

Thus a good pre-operative evaluation of the extent of retinal detachment and the localisation of breaks aids in deciding to opt for the ideal surgery. The type of surgery to be performed has to be individualised accordingly. In this study we have found that scleral buckling proved to be better in term of functional outcomes compared to pars plana vitrectomy. The reason for it may be attributed to better pre-operative visual acuity in the scleral buckling group. The pars plana vitrectomy group in the other hand though achieved anatomical reattachment at par with the scleral buckling group, the functional

outcome was low. However with the advent of improved instrumentations and better knowledge of the surgical skills the pars plana vitrectomy is gaining its pace in more complicated case of rhegmatogenous retinal detachment.

LIMITATION

The main limitation of the study is the small study group. The study can be done in a larger population group for better outcome. The follow up period is less. Long term follow up is of utmost necessity to look for any complications developing in late period.

PART III

ABBREVIATION

- SRF- Sub Retinal Fluid
- CSF- Cerebro Spinal Fluid
- MVR- Massive Vitreous Traction
- MPP- Massive Periretinal Proliferation
- RPE- Retinal Pigment Epithelium
- PVD- Posterior Vitreous Detachment
- RD- Retinal Detachment
- SB- Scleral Buckling
- IOP- Intraocular Pressure
- RRD- Rhegmatogenous Retinal Detachment
- MHz- Mega Hertz
- PVR- Proliferative Vitreo Retinopathy
- CRA- Central Retinal Artery
- CRAO- Central Retinal Artery Occlusion
- SF_6- Sulphur Hexafluoride
- C_3F_8- Perfluoroproprane
- C_2F_6- Hexafluoroethane
- PPV- Pars Plana Vitrectomy
- SB- Scleral Buckling
- PFCL- Per Fluoro Carbon Liquid
- BCVA- Best Corrected Visual Acuity
- SOSR- Single Surgery Success Rate
- PsRD- Pseudophakic Rhegmatogenous Retinal Detachment
- SD- Standard Deviation

- HST- Horse Shoe Tear
- ST- Supero Temporal
- SN- Supero Nasal
- IT- Infero Temporal
- IN- Infero Nasal
- Log MAR-Logarithm of Minimum Angle Of Resolution
- PHPV- Persistent hyperplastic primary vitreous

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PROFORMA

Name: Age: Sex:

Occupation: Address:

Registration Number:

Contact number:

History of presenting symptoms:

H/O defective vision: onset, duration

H/O floaters

H/O photopsia

H/O visual field defect

Past history and familyhistory:

Ocular examination: Right Eye Left Eye

Best Corrected Visual Acuity:

Intraocular Pressure:

Slit lamp Examination:

Fundus Examination:

1. extent of detachment
2. macula
3. number of retinal breaks
4. location of break
5. peripheral degeneration

Diagnosis:

General Physical Examination:

Surgery:

Results:

Anatomical Functional

Post-Operative Visual Acuity:

Follow up:

Remarks:

MASTER CHART

SN	IP no.	Name	Age	Sex	D (Days)	Eye	LS	Preop VA	Log MAR preop VA	Extent	BT	BN	Loc	Type of sx	AR	Postop VA	Log MAR postop VA	Reason for retina NA	FES1	FES2
1	12462	Jegadeesh	24	M	10	OD	P	HM	3.0	2 Q	H	1.0	ST	SB	A	6/12	0.30		P	
2	24333	Sumeeth	22	M	15	OS	P	2/60	1.5	2 Q	H	1.0	IT	SB	A	6/24	0.60		P	
3	20723	Sumathy	27	F	20	OS	P	6/60	1.0	2 Q	D	1.0	IT	SB	A	6/18	0.48		P	
4	19701	Praveen	20	M	15	OS	P	2/60	1.5	2 Q	H	2.0	IT	SB	NA	2/60	1.48	PVR+B	P	
5	487496	Gowri	55	F	20	OS	PS	1/60	1.8	2 Q	H	2.0	ST	SB	A	6/36	0.78		PS	
6	488901	Moorthy	55	M	5	OD	PS	HM	3.0	1 Q	HST	2.0	ST	SB	A	6/24	0.60		P	L-B
7	54701	Wilson	22	M	7	OD	P	5/60	1.1	1 Q	H	1.0	ST	SB	A	6/36	0.78		P	L-B
8	57294	Sekar	46	M	15	OD	PS	1/60	1.8	1 Q	HST	1.0	ST	SB	A	6/36	0.78		P	
9	481713	Ramesh	57	M	7	OD	PS	HM	3.0	2 Q	HST	4.0	IT	PPV	A	5/60	1.08		P	
10	477250	Sampath	60	F	20	OD	PS	HM	3.0	2 Q	H	3.0	IN	PPV	A	6/36	0.78		P	
11	1029	Roopa	65	F	18	OD	PS	1/60	1.8	2 Q	H	>5	ST	PPV	A	4/60	1.18		PS	
12	485134	Arun	12	M	7	OS	PS	HM	3.0	T	H	2.0	IT	PPV	A	6/60	1.00		P	
13	48528	Parvathy	40	F	19	OS	P	6/60	1.0	ST	HST	1.0	IT	PPV	A	6/60	1.00		P	
14	486211	Bharathan	75	M	21	OS	PS	CFCF	2.0	T	H	>5	ST	PPV	A	4/60	1.18		A	
15	484567	Varadhan	72	M	20	OD	PS	HM	3.0	T	HST	2.0	IT	PPV	NA	2/60	1.48	PVR	P	
16	485945	Durairaj	75	M	15	OD	PS	2/60	1.5	T	H	4.0	ST	PPV	A	5/60	1.08		P	
17	486291	Muniama	53	F	18	OS	PS	CFCF	2.0	2 Q	H	2.0	IT	PPV	A	6/60	1.00		P	
18	485566	Selvaraj	65	M	20	OS	PS	HM	3.0	T	E			PPV	NA	1/60	1.78	residual SRF+B	P	
19	32907	Murugesan	34	M	15	OD	P	3/60	1.3	ST	HST	1.0	ST	PPV	A	5/60	1.08		P	L-B
20	37124	Shantha	47	F	7	OD	P	1/60	1.8	2 Q	H	>5	IT	PPV	A	6/60	1.00		P	
21	488393	Ali	47	M	15	OD	P	6/60	1.0	1 Q	H	>5	ST	PPV	A	6/24	0.60		P	
22	48760	Srimulu	59	M	21	OS	PS	1/60	1.8	T	HST	3.0	ST	PPV	NA	2/60	1.48	MH	PS	
23	487090	Murugan	43	M	5	OD	PS	HM	3.0	ST	H	4.0	ST	PPV	A	5/60	1.08		P	
24	487616	Poonamma	60	F	10	OD	PS	HM	3.0	ST	H	2.0	ST	PPV	A	5/60	1.08		P	
25	506583	Peter	58	M	15	OD	PS	4/60	1.2	1 Q	HST	1.0	ST	SB	A	6/60	1.00		P	L+B
26	506832	Rabina Banu	50	F	20	OS	P	2/60	1.5	2 Q	H	2.0	SN	SB	A	6/60	1.00		P	
27	508377	Esaiya	30	M	18	OS	P	4/60	1.2	2 Q	H	2.0	IN	SB	A	6/60	1.00		P	
28	505778	Narasimma	55	M	20	OD	PS	HM	3.0	2 Q	H	1.0	ST	SB	NA	3/60	1.30	residual SRF	P	
29	10326	Antony	65	M	12	OS	PS	HM	3.0	2 Q	H	4.0	IT	SB	A	6/60	1.00		P	
30	96632	Satish	23	M	20	OD	P	1/60	1.8	ST	D	1.0	IN	SB	A	6/36	0.78		P	

KEY TO MASTER CHART

- SN- Serial Number
- IP No- Inpatient Number
- D- Duration
- OD- Right Eye
- OS- Left Eye
- M- Male
- F- Female
- LS- Lens Status
- PS- Pseudophakic
- P- Phakic
- VA- Visual Acuity
- HM- Hand movement
- CFCF- Counting Finger Close to Face
- Log MAR- Logarithm of Minimum Angle of Resolution
- Q- Quadrant
- T- Total
- ST- Subtotal
- BT- Type of Break
- H- Hole
- HST- Horse Shoe Tear
- D- Dialysis
- BN- Number of Breaks
- Loc- Localisation of Breaks
- ST- Super Temporal

- SN- Super Nasal
- IT- Infero Temporal
- IN- Infero Nasal
- Sx- Surgery
- PPV- Pars Plana Vitrectomy
- SB- Scleral Buckling
- AR- Anatomical Result
- A- Attached
- NA- Not Attached
- PVR- Proliferative Vitreo Retinopathy
- B- Break
- SRF- Subretinal Fluid
- MH- Macular Haemorrhage
- FES- Fellow Eye Status
- L–B - Lattice without breaks
- L+B - Lattice with breaks